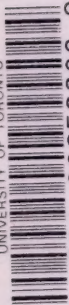



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GYNECOLOGICAL
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TUBERCULOSIS

GYNECOLOGICAL AND OBSTETRICAL TUBERCULOSIS

BY

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PREFACE

The current literature contains exhaustive references to the various forms of tuberculosis which are of especial interest to the gynecologist and obstetrician. However, few monographs dealing exclusively with the subject have been written.

Pulmonary tuberculosis is one of the most frequent diseases, and when present in the pregnant woman has a definite bearing on the ultimate outcome of the case.

Tuberculosis of the female genital tract and peritoneum is of frequent occurrence and is usually secondary to tuberculosis elsewhere in the body. Not only do these cases exhibit characteristics requiring special local treatment but, due to the fact that other foci of tuberculosis are generally present elsewhere, often in the lungs, particular care should be exercised in the choice of an anesthetic and during convalescence following any surgical procedure. Furthermore many surgical patients who are suffering from some non-tuberculous pelvic lesion are the incumbents of pulmonary tuberculosis and, therefore, require special safeguards, both during and following operation. As has been stated, references to tuberculosis, as it has bearing upon gynecologic and obstetric practices, are rife in the current literature, but the space devoted to this subject in the text books is often extremely brief.

For these reasons an attempt has been made to present the entire subject in one volume.

No effort has been made to utilize all the literature bearing on the text contents in the present monograph. An endeavor has, however, been made to incorporate references to the more important articles bearing upon the various subjects.

Some of the material employed in the Chapter on Pulmonary Tuberculosis and Pregnancy has been previously utilized in an article which appeared in the *American Journal of Obstetrics*. A part of the material used in the chapter on Congenital and Placental Tuberculosis has previously appeared in the Transactions of the American Gynecological Society. In both instances the material has been added to and brought up to date.

I wish to acknowledge my indebtedness to the following authorities

for much of the material utilized in the preparation of the historic review: Sir William Osler, Waldenberg, Predohl, Johne, and especially to Dr. J. Whitridge Williams, whose valuable monograph on Tuberculosis of the Female Generative Organs has been extensively drawn upon.

CHARLES C. NORRIS

PHILADELPHIA

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GYNECOLOGICAL
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GYNECOLOGICAL AND OBSTETRICAL TUBERCULOSIS

CHAPTER I

HISTORICAL SKETCH

Early Recognition of Tuberculosis—Varieties of the disease—Atrophic, cachectic, and ulcerative—Practical knowledge of certain features of tuberculosis held by pre-Hippocratic writers—History of the disease reviewed by Osler, and other illustrious members of the medical profession—Connection between tuberculosis nodes and phthisis first indicated by Sylvius (1695)—Baillie (1793) first to recognize tuberculosis in organs other than the lungs—Laennec, originator of stethoscope, recognized unity of scrofulous lymph nodes and phthisis—Open air treatment recommended by Samuel Morton (1834)—First successful inoculation, by Klencke (1843)—Various views regarding etiology of this condition—Valuable work of Furnival (1842) and others—Tubercle bacillus discovered by Koch—Genital tuberculosis first recognized by Morgagni—Historical review of genital tuberculosis.

Tuberculosis was probably recognized many hundreds of years before Christ. Hippocrates (B. C. 460-376) described phthisis and Colsus (B. C. 30) wrote of three varieties of the disease: atrophic, cachectic, and ulcerative. Hippocrates referred to tuberculosis as "the greatest and most dangerous disease and one that proved fatal to the greatest number." Isocrates believed that tuberculosis was contagious, and Aristotle mentions that the Greeks were of a similar opinion. Galen considered tuberculosis to be an ulcerative process and recommended that sufferers from this disease should live in a high altitude. Some students believe that the curse pronounced by Moses (about B. C. 1500) for disobedience had reference to tuberculosis (Leviticus, 26: 16, and Deuteronomy, 28: 22) and that the laws recorded in the Talmud (Mischna, B. C. 500) indicated the recognition of tuberculosis in cattle. Osler¹ states that the title of one of the lost books of Democritus, "On Those Who Are Attacked with a Cough after Illness," probably indicates that the pre-Hippocratic writers had practical knowledge of certain features of tuberculosis.

The history of tuberculosis includes a host of illustrious names, only a few of which are mentioned here, as the historical side of the disease

has already been so ably reviewed by Osler,¹ Waldenburg,² Predöhl,³ Johnes,⁴ and others.

Sylvius (1695) was the first to indicate the connection which exists between the tuberculous nodes and phthisis. Morton (1689), in his excellent book, showed the prevalence of tuberculosis and accomplished much towards obtaining recognition for its importance by the medical profession. Morgagni (1682-1771) regarded the disease in the light of an infection and believed it dangerous to perform autopsies upon tuberculous subjects. Stark (1785) accurately described miliary tubercles. Kortum (1790), Baume (1795), Hufeland (1796), and Cullen (1800) were of the opinion that scrofulous glands anteceded phthisis. Baillie (1793) was the first to recognize tuberculosis in organs other than the lungs. Portal (1780) and Vetter (1803) coincided with Baillie in his findings. Laennec (1819) recognized the unity of the scrofulous lymph node and phthisis, described the pathology as well as the physical signs present during the various stages of phthisis, and originated the stethoscope, by means of which accurate auscultatory findings were made possible. Samuel Morton (1834), a student of Laennec's, in a monograph entitled "Pulmonary Consumption," recommended the open air for these patients and gave excellent therapeutic advice regarding the treatment of phthisical patients.

Klencke (1843) performed the first successful inoculation, infecting a rabbit with tuberculosis by an intravenous injection. About this time various views were held regarding the etiology of this condition. Dupuy (1817) and Baron (1822) attributed it to hydatids. Furnival (1842) believed the condition to be due to deficient enervation. Engel (1844) thought the disease was similar in general character to typhoid fever, but caused by a different exudate. Alison (1824), Glover (1847), Simon (1850), and Villemin (1865) were of the opinion that tuberculosis was the result of a specific infection. Langhans (1868), Schuller (1877), Tappeiner (1878), and others performed more or less successful experimental inoculations, the results of which were finally settled by the work of Cohnheim and Salmonsens (1879), who positively reproduced the lesion by inoculating the anterior chamber of a rabbit's eye.

Friedländer (1873), Koster (1873), and Weigert (1879-1882) contributed valuable work. Aufrecht (1881) and Baumgarten (1883), independently of Koch, described bacilli in the centers of tubercles, but did not prove that they were the infecting and active agents.

The tubercle bacillus is the cause of tuberculosis. For many years, prior to the discovery of the tubercle bacillus by Koch⁵ in 1882 and

public announcement thereof on March 24, before the Physiological Society of Berlin, the infectious nature of the disease was suspected. In 1843, Klencke successfully accomplished the transmission of the disease, employing tuberculous material, and in 1865 Villemain⁶ did likewise. Baumgarten⁷ also reported the presence of what were probably tubercle bacilli in tissue, but had not proved the pathogenesis of the organism by inoculation.

GENITAL TUBERCULOSIS

Morgagni⁸ was the first to recognize genital tuberculosis. This observer, upon performing an autopsy upon a girl of twenty years of age who had died of tuberculous peritonitis, found the uterus and adnexa filled with caseous material and believed that these organs were the primary focus of the disease. The importance of Morgagni's observation was apparently not recognized, for no further mention is found of genital tuberculosis until the reports of Reynaud⁹ and Senn¹⁰ in 1831. Reynaud described two cases of genital tuberculosis occurring in phthisical patients. Twelve years later Louis¹¹ also recorded cases. In 1853 Virchow¹² described genital lesions which were secondary to tuberculosis of the urinary tract.

In reviewing the literature of this period, cognizance must be taken of the fact that the etiology of tuberculosis was unknown and even its pathology was not well understood, so that as a result many lesions were attributed to this variety of infection which are now known to have no connection with tuberculosis. Thus we find Waller¹³ describing uterine myomata and writing that they were analogous to the "fleshy tubercle of the womb" described by William Hunter. Similar erroneous observations were made by Düntzer¹⁴ and Osiender,¹⁵ while Lisfranc¹⁶ and Thiry¹⁷ believed Nabothian cysts to be of tuberculous origin and remarked upon the ease with which this form of tuberculosis was cured. Boivin and Dugès¹⁸ describe tuberculous adnexitis and give an excellent illustration of a specimen. As time went on, a greater number of cases were recorded in the literature and a more accurate comprehension of the pathology and symptomatology of genital tuberculosis became prevalent. Kiwisch,¹⁹ Giel,²⁰ and Paulsen²¹ contributed valuable information on this subject. Hegar's²² important work appeared in 1886. Williams,²³ in his admirable historical review of genital tuberculosis, remarks that an interesting feature of the history of this condition is that for so long the ovaries were not considered receptive to the infection. Even such close observers as Virchow¹² and

Rokitansky²⁴ were of this opinion, and as late as 1880 Brissaud²⁵ stated that there was not a single specimen of tuberculosis of the ovary in the Museum of the College of France. Koch's discovery of the tubercle bacillus added stimulus to the study of genital tuberculosis and made it possible to positively diagnose the condition.

In 1883 Babes²⁶ demonstrated tubercle bacilli in the vaginal discharge in a case of rectovaginal fistula. This is the first authentic record of such findings. Hegar's masterly monograph entitled "*Die Entstehung, Diagnose und chirurgische Behandlung der Genital Tuberculose des Weibes*" (Stuttgart), which appeared in 1886, and the work of Chiari,²⁷ Bierfreund,²⁸ Baumgarten,²⁹ Krönig,³⁰ Bandl,³¹ Martin,^{32, 33} Schauta,³⁴ and later the valuable contributions by Kelly³⁵ and Osler³⁶ and by many others appeared in succession and have done much towards elucidating the pathology, symptomatology, and treatment of tuberculosis of the female genitalia.

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CHAPTER II

THE DIAGNOSIS OF TUBERCULOSIS OF THE FEMALE GENITAL TRACT BY LABORATORY METHODS

Cervix and lower genital tract—Methods of treatment—Curettage—Value of examination of leukorrheal discharge in tuberculous endometritis—Organisms likely to be mistaken for the tubercle bacillus—Smegma bacilli—Study of morphology, and of staining by ordinary methods—Grethe method—Czaplewski method—Etiology of smegma bacilli—Bacillus leprae—Resemblance to tubercle bacillus—Differentiation—Cultural methods and clinical study—Animal inoculation almost positively diagnostic—Danger of mistaking malignant neoplasms for certain forms of tuberculosis—Diagnostic use of tuberculin in gynecological conditions—Summary of histologic examination.

CERVIX AND LOWER GENITAL TRACT

In lesions of these localities biopsy offers an easy and almost certain means of diagnosis and, if this method is employed, the histologic as well as the bacteriologic examination is available. If the lesions be ulcerative or friable, a light curettage may be performed and the material thus obtained similarly employed. An anesthetic is not necessary. Curettage is of little value in the hypertrophic varieties of tuberculosis, such as may be encountered in the vagina and external genitalia, unless there be loss of continuity of the surface. For lesions within the cervical canal or for the ulcerative or hypertrophic varieties of tuberculosis of the cervix, curettage is of distinct value.

For those cases in which biopsy or curettage is not advisable, or as a preliminary measure, the discharge may be examined. For this purpose the parts should be thoroughly cleansed and a dressing or tampon applied. Some hours later the exudate which has collected upon the under surface of the dressing may be examined.

The most frequent site for tuberculosis in the female genital tract is the fallopian tubes. Tuberculous salpingitis, except in the early stages, usually occludes the inner portion of the tube, so that the tubal contents do not gain free access to the uterine cavity. Even if the uterine ostium of the tube is patulous, the opening is generally so small that but little

of the tubal exudate escapes, and that which does is likely to be mixed with such a relatively large amount of uterine and cervical secretion that, by the time it is obtainable at the external os, the demonstration of the tubercle bacillus is extremely difficult. Although the organism is found, it is impossible to determine whether it is from the tube or from the endometrium. However, the latter is a comparatively unimportant point, inasmuch as when the corporeal endometrium is involved the tubes are nearly always affected. To obtain material for examination, the vagina and portio vaginalis should be thoroughly cleansed and two close fitting tampons applied to the cervix. The secretion thus obtained on the upper surface of the upper tampon after the latter has been in place for twenty-four hours is utilized. Immediately after removal of the tampon additional secretion should be secured from within the cervical canal by means of a sterile platinum loop.

Cummins¹ has reported good results with this method. Negative results do not exclude the tuberculous origin of the disease, particularly when the tubes alone are involved.

In tuberculous endometritis the examination of the leukorrheal discharge secured by this method is of definite value, and, whereas too much stress should not be paid to negative results, the proportion of cases in which it is possible to demonstrate the tubercle bacillus is considerable. In the selection of material for examination, especial attention should be given to cheesy particles, for it is in these that the organisms are most frequently found. In cases of tuberculous endometritis, tubercle bacilli are more numerous in the discharge immediately after the cessation of a menstrual period.

Curettage of the endometrial cavity and the examination of the curettings is naturally a much more certain method of diagnosis than is the examination of the secretion, and in some cases is a desirable procedure, which may be employed for diagnostic purposes as well as for other reasons. Occasionally the removal of one or two strips of endometrium by means of a small curette for diagnosis is a justifiable operation. As a general rule, however, curettage, unless immediately followed or preceded by an abdominal section, is inadvisable. A salpingitis is nearly always present, and curettage alone is likely to be the means of setting up an exacerbation of the infection.

When depending upon the staining of the tubercle bacillus in preparations of secretion obtained from the cervix or lower genital tract, the great difficulty is to differentiate the tubercle bacillus from other organisms which may be present and which are morphologically and tinctorially similar. A number of organisms which possess nearly the same

size, shape and staining properties may be encountered. Chief among these is the smegma bacillus.

Organisms Likely to Be Mistaken for the Tubercle Bacillus.—

SMEGMA BACILLI.—These organisms morphologically and by the ordinary staining methods closely resemble tubercle bacilli. The normal habitat of the smegma bacillus is in the external genitalia and it is especially common in the interlabial folds in women and around the corona of the glans in men. It is also found in the skin between the thighs and is not infrequent in the vagina, especially the lower portion. Gottstein,² Ritter,³ Labbs,⁴ Alvarez and Taval,⁵ Matterstock,⁶ Klemperer,⁷ and others have demonstrated the organism in various localities on the skin surface of the body, around the natural opening, and even upon the coating of the tongue and teeth. The bacillus is of frequent occurrence in the urine (especially in specimens passed voluntarily) and in the feces. It appears in especially large numbers in any area where normal skin secretions are allowed to collect, and has been frequently observed about the umbilicus, in the cerumen of the ear, about the teeth, etc. In this respect its occurrence is somewhat dependent on the degree of cleanliness of the patient. Regarding the frequency with which the smegma bacillus occurs in the genital tract, Brereton and Smith,⁸ in 126 insane or uncleanly patients, found red staining bacilli in 85 (67.5 per cent) after decolorization by 25 per cent sulphuric acid, while they occurred in only 19 (22 per cent) of these patients after methylene blue had been employed as a counter stain after decolorization. They were present in 13 per cent after decolorization by acid alcohol or Labarraque's solution. In a second series of twenty ordinary cases these authors found smegma bacilli in 13, or 65 per cent, after the use of sulphuric acid only, and 2 or 1 per cent after counter staining. Young and Churchman,⁹ in 24 tests, found smegma bacilli present in 46 per cent of cases. As this organism is so frequently present in the neighborhood of the external genitalia, its differentiation from the tubercle bacillus, when studying material from this locality, is of extreme importance. The smegma bacillus is non-pathogenic. In earlier times a number of operations have been performed under a misconception because of a lack of knowledge upon this point (Labbs,⁴ Krönig,¹⁰ Bunge and Trentenrath¹¹).

A study of the morphology and of staining by the ordinary methods, employing inorganic acids as decolorizers, is useless as far as differentiation between the tubercle bacillus and smegma bacillus is concerned, although it is claimed by some observers that the smegma bacillus is slightly shorter than the tubercle bacillus. Certain special stains are, however, moderately reliable. Smegma bacilli are decolorized somewhat

more easily than are tubercle bacilli and may be decolorized with absolute alcohol, although Moller ¹² believes them not only alcohol, but acid proof, and admits no tinctorial difference from the tubercle bacillus. Brown ¹³ states careful work to have shown that no staining methods differentiate tubercle from smegma bacilli: he recommends Petroff's medium as a differentiating agent for tubercle and smegma bacilli.

Bunge and Trentenroth ¹¹ *Method*.—I. Fixation of smears by absolute alcohol for three hours.

2. Five per cent chromic acid for at least fifteen minutes.
3. Wash in several changes of water.
4. Stain in carbol fuchsin, in usual manner.
5. Decolorize with dilute sulphuric acid for three minutes, or pure nitric acid for one or two minutes.

6. Secondary decolorization combined with secondary staining in a concentrated alcoholic solution of methylene blue for at least five minutes.

Result: Bunge and Trentenroth state that in all cases smegma bacilli were decolorized, and only rarely did they find one or more bacilli reddish violet, but by no means so intense (tubercle bacilli from sputum only were employed as controls).

Grethe ¹⁴ *Method*.—The preparation is stained in the ordinary manner with carbol fuchsin, washed, and, without further decolorization, is treated with a concentrated solution of methylene blue in absolute alcohol. The tubercle bacilli remain red, while the smegma bacilli are blue. Weichselbaum ¹⁵ reported excellent results with this method.

Czaplewski ¹⁶ *Method*.—Treat and stain in the usual manner with heated carbol fuchsin. The excess of the fluid is drained off and the preparation immersed for five minutes in fluorescein methylene blue and then in concentrated alcoholic solution of methylene blue for one-half to one minute and rapidly washed in fresh water and mounted.

In staining smear preparations for the purpose of differentiating the smegma bacillus, it is wise to place a few tubercle bacilli of known authenticity upon the cover glass, some distance from the material for examination, as a control. If urine is to be examined, a catheterized specimen, the external urinary meatus having first been carefully cleansed in order to avoid contamination, should be utilized. As has been stated, biopsy or inoculation methods offer a more certain means of diagnosis than does the microscopic examination and smear preparation from the genital tract when tuberculosis is suspected, *and should be resorted to in all doubtful cases*.

All investigators agree on the non-pathogenic character of the smegma bacillus, and animal inoculation can thus be safely depended upon in all

doubtful cases. Young and Churchman⁹ insist that the presence of the smegma bacillus cannot be excluded from specimens of urine by cleansing of the external genitalia, but that urethral irrigation must be frequently undertaken. Brereton and Smith⁸ believe that no method of differentiating the tubercle bacillus from the smegma bacillus by staining is entirely adequate for all cases, and that the successful cultivation of the latter organisms is open to question.

The smegma bacillus was first cultivated by Czaplewski.¹⁷ Novey¹⁸ recommends the following media: Agar-agar is cooled to 50° C. and mixed with a small quantity (about 2 c.cm.) of fresh, sterile human blood. The mixture is poured into Petri dishes and placed in the incubator at 37° C. for twenty-four to forty-eight hours.

Subcultures, according to Möller,¹² may be grown upon glycerin agar-agar. The organism may also be cultivated in bouillon, potato, or glycerin agar, at 37° C.; upon the latter, colonies appear in minute, whitish or yellowish scale-like dots, which later become somewhat rounded and possess a soft velvety or corrugated surface. The growth is slow.

BACILLUS LEPRÆ.—This organism morphologically closely resembles the tubercle bacillus. The frequent intracellular position and often parallel or package-like arrangement under such circumstances, and the tendency which they possess to occupy lymphatic spaces, are points aiding in their differentiation. They stain somewhat more readily than do the tubercle bacilli. None of these characteristics is, however, sufficiently marked to positively differentiate these two organisms, and cultural methods and a clinical study of the case are required for a positive diagnosis. The bacillus lepræ is cultivated upon artificial media with great difficulty and some doubt exists as to whether it has ever been grown freely upon the media usually employed for the cultivation of the tubercle bacillus; indeed, Jordan¹⁹ states that saprophytic growth on the part of the leprosy bacillus is entirely unknown. On the other hand, McFarland²⁰ states that in cultures there is a delicate filamentous arrangement of the lepræ bacilli, especially where they have become accustomed to a saprophytic existence.

There is a large number of other acid proof bacteria (about forty) which, however, as a rule, can be easily differentiated from the tubercle bacillus. Such organisms have been isolated from butter (Petri,²¹ Rabinowitsch,²² Korn²³) and hay (Möller¹²). In some cases, it is almost impossible to differentiate these organisms from the tubercle bacillus, although the rapid growth of the hay and butter bacilli in artificial media, at about 20° C., is their chief differential point. As a rule, the clinical picture is sufficient to differentiate the organism; however, Frankel,²⁴

Rabinowitsch,²² and Marzinowski²⁵ have demonstrated these organisms in pathologic conditions in the lungs. The possibility of these bacilli being present in conjunction with the tubercle bacillus must also be taken into consideration. Leprosy is a rare disease in this climate, and the clinical symptoms are usually sufficient upon which to differentiate the disease from tuberculosis of the genital tract.

As can be seen from the foregoing, ways of demonstrating the tubercle bacillus in the discharge by staining methods are open to doubt. The finding of characteristic organisms in the tissue may be considered moderately reliable. When, however, sufficient tissue is obtainable to demonstrate the organism in it, a histologic diagnosis which is equally reliable is usually possible. Tubercle bacilli, in certain forms of tuberculosis and in certain stages of the disease, are present only in small numbers, and their demonstration consequently is difficult, whereas, on the other hand, diagnosis by histologic examination is usually easy. Animal inoculation offers an almost positive method of diagnosis. It is more certain when ground up particles of the suspected tissue are employed than when only the exudate is utilized. The disadvantage of animal inoculation is the time required. Three or four guinea pigs should be inoculated.

The danger of mistaking malignant neoplasms for certain forms of tuberculosis, particularly those occurring in the cervix and external genitalia, should be taken into consideration when obtaining tissue for diagnosis. For fear of disseminating a malignant tumor, it is therefore advisable, when performing biopsy, to employ the cautery knife heated to a dull red, or the cut edges of the wound may be immediately seared following the removal of the suspected tissue. Rapid diagnosis is an important factor in these cases and is an additional reason for the employment of histologic means, rather than waiting for the slower inoculation method. The latter may, however, be utilized with advantage as an auxiliary to the histologic examination, and is especially valuable when the rare hypertrophic variety of tuberculosis of the external genitalia is suspected.

The Diagnostic Use of Tuberculin in Gynecological Conditions.

—Pankow²⁶ states that, in the cases examined by him, he observed focal reactions in the absence of tuberculous foci. In three cases of pelvic inflammatory disease, of non-tuberculous origin, he obtained a focal reaction, but in one of these the local symptoms may have been caused by menstruation. Sahli²⁷ has emphasized the fact that sensitiveness is increased in the premenstrual period. Beer²⁸ asserts that such focal reactions in non-tuberculous cases must be exceptional. Mohr²⁹ is of the opinion that a negative response excludes tuberculosis; but Beer thinks

a general, plus a focal, response is practically invariably due to a focal tuberculosis, and that such a response locates the diseased area. A general, minus a focal, response is of no practical value, as the most careful examination cannot exclude tuberculosis in other parts of the body, which may give the general reaction. Servaes ³⁰ says that Möller made 20,000 injections without any bad effects.

In speaking of pulmonary tuberculosis, Brown ³¹ states that the danger from the proper use of the tuberculin test is slight, but in some unsuitable cases very real. Shattuck ³² believes the subcutaneous test the most reliable and has never seen untoward results beyond a disturbance of two or three days, except in one case of Addison's disease. Jane-way ³³ has also observed a fatal issue from the use of this test in Addison's disease. Koplik ³⁴ makes an almost routine use of the cutaneous von Pirquet test in children.

The author has had no personal experience with the use of tuberculin as a diagnostic agent in patients suffering from gynecologic lesions. It would appear that its use is not entirely free from danger and the results obtained are somewhat uncertain. It is probably of little or no practical value. The fact that tuberculosis of the female genital tract and peritoneum is generally secondary to tuberculosis elsewhere in the body and that pulmonary or other forms of tuberculosis are frequent and often quiescent greatly nullifies the value of the tuberculin test. The same may be said regarding the von Pirquet and the complement fixation test.

Summary of Histologic Examination.—This method offers a rapid and quick method of diagnosis. The various forms of tuberculosis can nearly always be diagnosed by it with certainty and the possibility of malignancy can be easily determined. As a supplement to it, a part of the tissue may be utilized for animal inoculation, and this is a valuable aid, but has the distinct disadvantage of being time consuming, a point which is especially to be avoided in those cases in which the possibility of malignancy cannot be excluded. With light curettage, such as may be performed upon ulcerative lesions of the cervix or lower genital tract, enough tissue may sometimes be obtained for a histologic examination. The employment of such material for animal inoculation is of distinct value. The staining of secretions, often as a preliminary method, is not without value; negative results do not exclude with certainty the possibility of the tuberculous character of the lesion, and, owing to the similarity of the smegma bacillus to the tubercle bacillus, positive results cannot be absolutely relied upon.

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CHAPTER III

PATHOLOGY

Two distinct forms of genital tuberculosis, ulcerative and hypertrophic—Histologic examination of ulcerative form—Hypertrophic variety demonstrated by staining or inoculation—Tuberculosis of the vagina; ulcerative form most frequent variety—Histologic examination—Hypertrophic form in relation to miliary tuberculosis—Tuberculosis of the cervix, ulcerative, papillary, miliary, and interstitial—Histologic examination—Characteristics, and differentiation—Corporal endometritis; miliary and caseous—Study of histologic and pathologic characteristics—Myometritis, frequent occurrence in advanced cases of tuberculous endometritis—Infections of the endometrium—Intramural abscess, tuberculous deciduitis—Histologic examination—Placental tuberculosis—Macroscopic appearance, characteristics and forms—Intravillous tuberculosis—Intravascular chorionic lesions, and chorio-amniotic—Tuberculosis of fallopian tubes—Tuberculosis of the ovary—Peri-oöphoritis, and oöphoritis—Histologic examination.

TUBERCULOSIS OF THE EXTERNAL GENITALIA

As has been stated elsewhere, tuberculosis of the external genitalia may be either primary or secondary, the latter being by far the most frequent. As the vulva and adjacent structures are covered by modified skin, tuberculosis occurring in this locality is similar in its general macroscopic and histologic characteristics to tuberculosis of the cutaneous surface as found in other parts of the body. As a result, however, of moisture, heat, friction, and local anatomic conditions, and not infrequently due to the presence of irritating discharges, certain modifications of the ordinary tuberculous lesions found in other skin areas may occur. As a general rule, the pathologic processes which occur here closely resemble the ordinary forms of cutaneous tuberculosis.

Undoubtedly the rarity of tuberculosis of the external genitalia may be largely explained by the protective qualities of the squamous epithelium and particularly of the horny layer of the latter. In young children the development of the outer horny layer is less marked and, as a result, in such subjects this locality is less immune. In the adult constant bathing of the parts in leukorrheal discharges, which more or less macerates the protective covering, probably acts as a predisposing factor to infection. The irritating properties of the discharge likely to be

present as a result of lesions in the upper genital tract are also predisposing causes by producing a vulvitis, which is due to toxins. Experimental studies have amply proven the relationship existing between pre-existing inflammation and infection with the tubercle bacillus in this locality.

Tuberculosis of the external genitalia may be divided into two distinct forms, the ulcerative and the hypertrophic, the former being much the most common. Combinations of the two are, however, not infrequent.

Ulcerative Form.—The lesions may be single or multiple and vary in size from the microscopic to huge ulcers, involving not only the external genitalia, but also the skin perineum, vagina, and adjacent structures. Vulvovaginal ulcers are relatively frequent and may originate either in the vagina or vulva. The clitoris and surrounding parts are frequently involved. Ulcers may occur either on the labia major or minor, or both may be attacked. Contact ulcers on the opposite labium occasionally are present. Fistulae leading to tuberculous foci in the lower alimentary tract, near-by osseous system, or other localities may be present.

The vulvar surface adjacent to the ulcer is generally the seat of a more or less well marked chronic inflammation, the skin being reddened and swollen. Pigmentation is often present.

The initial genital lesion is usually a small swelling, papule-like in character, which enlarges, softens and breaks down, leaving in its center an irregular necrotic ulcer. Less frequently the primary pathologic process is a minute shallow ulcer. In either event, the subsequent course is usually slow, but progressive, and more or less swelling and hypertrophy are likely to occur. The base of the ulcer is usually dark necrotic, but may be reddish, pinkish, or grayish in color. Small yellowish or grayish elevations are not infrequently present, while in some instances more or less typical tubercles may be observed. These are minute, grayish or yellowish, semitranslucid homogeneous elevations, and are generally observed on the floor of the ulcer. To the touch the base of the ulcer imparts a soft, somewhat velvety feel. The walls of the lesion are elevated, infiltrated, somewhat edematous and often undermined, and may be the seat of enlarged veins. In some instances the ulcers are friable and tend to bleed easily when traumatized. The older lesions are generally fairly firm and exhibit but little tendency to hemorrhage. One of the chief characteristics of the ulcers is their chronic appearance. Not infrequently, in old chronic cases, the ulcers are to a certain extent serpiginous and leave behind scar tissue as they advance in other di-

rections. More or less edema and swelling are usually present in the neighborhood of the ulcer. In some instances, where the ulcer is limited to one side, the opposite vulva is enlarged or hypertrophied. Enlarged or varicose veins are frequently present, especially in aged patients. An inguinal adenitis is a frequent accompaniment of the condition.

On histologic examination, the ulcers present the usual characteristics of skin tuberculosis. The tissue is infiltrated with chronic inflammatory products, the blood vessels are enlarged and thrombi may be present. The surface may present characteristic caseous structures, and typical tuberculous giant cells are nearly always present. The latter, together with the tubercles, are the chief diagnostic features. Tubercle bacilli are present, but are frequently difficult to demonstrate by staining methods. They are often few in number, but can be discovered if a careful search is made. In some instances the organisms can be demonstrated in the discharge from the ulcer; in this, however, they are generally sparsely distributed, and consequently difficult to find. Furthermore, the dangers of contamination from tubercle bacilli bearing discharges from other lesions must be borne in mind. For these reasons the examination of the discharges is generally unsatisfactory, and a better method is to carefully cleanse the surface of the lesion, lightly curette it and examine the material thus obtained. In cases of doubt biopsy combined with animal inoculation offers the surest and most satisfactory means of diagnosis.

Hypertrophic Variety.—In this variety of tuberculosis the infection usually results in moderate sized tumor-like masses, the labia being perhaps the most frequent area involved. The lesions are generally fairly firm, somewhat rounded outgrowths, often covered by thickened wrinkled skin. Cases have been mistaken for sarcoma, carcinoma, condyloma acuminata, and true elephantiasis. One or both labia may be attacked, but a unilateral involvement is the most frequent. More or less edema and swelling of the opposite side and adjacent structures is, however, the rule in advanced cases. Engorged blood vessels are sometimes observed. As will be noted, the macroscopic appearance of this form of tuberculosis presents nothing characteristic.

On histologic examination, the skin is usually found to be thickened, the affected area fairly vascular, and a well marked increase of connective tissue is everywhere observed. A considerable infiltration with a chronic inflammatory exudate is present, although this is less marked than is observed in the ulcerative lesion. Here and there tubercles containing the characteristic giant cells may be seen. These, however, are not plentiful, and a number of sections should be examined in suspected cases before the possibility of tuberculosis is excluded. Tubercle bacilli

are generally present only in small numbers and are therefore usually difficult to demonstrate in stained sections.

On account of the confusion which has existed in the past regarding this variety of tuberculosis, the author believes that no case should be classified as tuberculosis unless the characteristic lesions, tubercles and giant cells are observed, or tubercle bacilli demonstrated either by staining or inoculation methods. The latter is the best and most certain procedure.

TUBERCULOSIS OF THE VAGINA

Tuberculosis of the vagina is similar in its general pathologic characteristics to tuberculosis of the external genitalia. It is usually of the secondary variety and may result from a direct extension from nearby foci, such as the cervix or intestines, or from a hemogenic or lymphogenic infection. Direct implantation, either from exogenic organisms by means of the fingers, douche nozzle, or coitus, or by tubercle bacilli bearing discharges originating in the upper genital tract, may occur.

Three varieties have been observed, the ulcerative, the hypertrophic and the military.

The Ulcerative Form.—This is the most frequent variety, and in general presents the same characteristics as when present on the external genitalia. Indeed vulvovaginal lesions are relatively frequent.

The ulcers may be single or multiple and are perhaps most frequently present in the floor of the vagina. The lesions vary considerably in size; huge ulcers involving almost the entire vagina and extending to the external genitalia and adjacent structures have been observed, and on the other hand, almost microscopic lesions have been recorded. The ulcers generally present a chronic appearance and possess infiltrated, elevated hyperemic and particularly undermined edges. The base is necrotic, brownish, blackish, pinkish, or grayish in color, moderately soft and friable to the touch, and is frequently studded with minute rounded grayish or yellowish semitranslucent elevations, which histologic examination shows to be tubercles. The surrounding vaginal mucosa is generally reddened and presents the usual appearance of a vaginitis. In the early stages the ulcers are shallow.

The lesions are to be differentiated from malignant neoplasm, syphilis, chancroids, and in children from gonorrhea, noma of the vulva, and other ulcerative lesions.

The presence of tuberculosis elsewhere in the body, the chronic char-

acter of the lesions, and the presence of tubercle-like elevations on the base of the ulcer are points suggestive of this variety.

On histologic examination, any doubts which may exist are easily cleared up. The vaginal mucosa surrounding the ulcer is thickened, hyperemic, and more or less infiltrated with chronic inflammatory products, and may contain an isolated tubercle. Sections through the ulcers show the absence of the normal superficial tissues, the floor of the ulcer being densely infiltrated with a chronic inflammatory exudate, and the surface consisting of necrotic granulation tissue. The presence of tubercles and the characteristic giant cells makes the diagnosis positive. Tubercle bacilli can generally be demonstrated in stained sections, if careful search for them is instigated.

Hypertrophic Form.—Cases of this kind in which the lesions have originated in the vagina itself are too few to draw from them definite conclusions regarding their characteristic appearance. By far the greater number of cases in which the hypertrophic form of tuberculosis has been present have resulted from a direct extension from a similar outgrowth in the cervix. The hypertrophic variety of tuberculosis is usually papillary in appearance, and more or less friable and necrotic. The tumor-like masses are bathed in an irritating, foul smelling discharge. The outgrowths are pinkish or grayish in color and frequently present extensive areas of necrosis. In the interstices on the surface collections of clotted blood and discharge are frequently present.

Histologically, the lesions present the usual characteristics of tuberculosis, although tubercles are less plentiful than in the former variety. In some specimens there is marked increase in the number of blood vessels, and a correlation with the macroscopic and clinical findings will usually show that these specimens are more friable, rapid in growth, and productive of more easily excited small hemorrhages, especially following trauma, than in the less vascular pathologic processes. Tubercle bacilli are present, but as a rule less numerous than in the ulcerative variety.

Miliary Tuberculosis.—In this variety of the disease, the vaginal mucosa is thickened, reddened, swollen, more or less edematous, and hyperemic. The entire vaginal lining is usually involved, although the inflammation is apt to be most marked in the floor of the canal. Scattered more or less profusely throughout the lining of the vagina are small grayish or yellowish semitranslucent discrete elevations—the tubercles. Occasionally one of these breaks down and a small ulcer results. Considerable discharge is usually present.

Histologic examination shows a well marked inflammation and the

usual characteristics of tuberculosis. Tuberculous giant cells and tubercle bacilli are generally present in considerable numbers. This variety of the disease is generally the result of a hemogenic infection, and is usually associated with a general miliary infection.

Combinations of the ulcerative, hypertrophic, and miliary forms may be present.

TUBERCULOSIS OF THE CERVIX

Cervical tuberculosis occurs in four distinct forms: the ulcerative, the papillary, the miliary, and interstitial. An analysis of 106 cases showed that 52 were of the ulcerative variety, 41 papillary, 7 miliary, and 6 interstitial. Combinations of these varieties are not infrequent. These statistics may to some extent be misleading, owing to the fact that in the late stages, when many of these cases were first observed, ulcerative lesions are prone to develop. Thus, a lesion which began as an interstitial type in the later stage may break through into the portio or cervical canal and present a condition which would probably be classified under the ulcerative variety. Cora¹ believes the papillary variety the most frequent, and bases this opinion upon the fact that, in the later stages, this variety frequently undergoes ulcerative changes.

Cervical tuberculosis is usually secondary; a few authentic primary cases have, however, been recorded. Beyea² analyzed 61 cases, with a view to ascertaining what portion of the cervix was most frequently attacked. In this series the portio alone was involved in 11, the supra-vaginal cervix alone in 6, and both in 44. The disease usually originates in the cervical canal.

Ulcerative Variety.—Cervices, the seat of this variety of tuberculosis, vary widely in appearance. All of the four varieties of cervical tuberculosis are prone to become ulcerative in their end stages. As a general rule, the pathologic process produced by the ulcerative variety of cervical tuberculosis resembles more or less closely the ulcerative lesions of carcinoma. Indeed, malignancy of some form has been the clinical diagnosis in a large proportion of cases, not only in the ulcerative variety, but also in the papillary forms. The ulcer may begin either in the portio vaginalis or in the cervical canal. The history usually shows that the disease has been slow, but progressive. The margins of the ulcers are often not markedly elevated, less so as a rule than in carcinoma, and are apt to be undermined and fairly soft. The base is covered with necrotic tissue and may be brown, black, yellow or gray in color. It is usually moderately soft and friable, but in some specimens is firm and

hard. Numerous minute grayish or yellowish semitranslucent discrete tubercles may be scattered over the floor of the ulcer. These may also be present in the walls of the ulcer and on the surface of the adjacent structures. Not infrequently the surface of the ulcer will be found to be partially covered by cheesy particles. The ulcers are usually single, but multiple lesions have been observed. The ulcers vary widely in size; in some specimens the place of the entire cervix and adjacent vagina is occupied by a large excavated necrotic cavity, while in others almost microscopic lesions have been described. In the advanced specimens involvement of the surrounding vagina is frequent. The adjacent covering of the vagina and the portion of the cervix not actually involved by the ulcers are usually reddened, and as has been stated, may contain small tubercles. The ulcers may extend upward into the body of the uterus, but the disease apparently exhibits some tendency toward remaining limited to the area below the internal os, although a tuberculous endometritis is frequently present.

Papillary Variety.—This variety usually originates from the vaginal surface of the cervix, but in rare instances may spring from the canal. It occurs usually as a cauliflower-like outgrowth, and is generally dark reddish or brownish in color, presents necrotic areas on its surface, and is covered with discharge. Firm smooth nodular dome-like elevations may be present, either in conjunction with the cauliflower type of tumor, or less frequently may constitute the chief pathologic process present. On section, the papillary variety of tuberculosis presents a smooth, fairly soft, somewhat translucent, moderate vascular pinkish, grayish or whitish appearance; small yellowish areas on the cut surface may be observed in some specimens. The tumor-like outgrowth may possess a well defined pedicle, but more frequently springs from a broad base. In the early stage this variety is usually single, but later numerous outgrowths are observed. As the disease progresses the tumor-like masses tend to undergo necrosis and ulceration.

Interstitial Variety.—In this variety the disease begins in the substance of the cervix, primarily causing a slight nodular swelling in one lip of the organ; this gradually increases in size and finally breaks down, leaving an irregular opening either on the portio or in the canal. The opening becomes larger as the result of a disintegration of tissues, and the final stage is a large crater-like cavity, together with involvement of much of the adjacent tissue. The walls of the cavity are similar in general macroscopic appearance to those of the ulcerative variety of the disease.

Miliary Variety.—In this variety the cervix is usually enlarged, the portio reddened and glistening, and scattered discretely over the surface are small grayish or yellowish semitranslucent elevations, which are the tubercles. These may be seen in various stages of development. Not infrequently one of these may break down, leaving a minute ulcer filled with whitish or yellowish cheesy material. The mucosa of the cervical canal is usually the seat of a tuberculous endocervicitis. The vagina may also be involved. The specimen is likely to be bathed in a moderate thin semipurulent discharge, intermixed with which cheesy particles may be present.

As a result of tuberculosis of the cervix, the canal may become occluded and a pyometra or, as it is sometimes termed, uterine phthisis may result. When this occurs the uterus becomes larger and softer, and the amount of leukorrhea is likely to become somewhat lessened as the discharge from the upper genital tract ceases to gain egress. Pyometra is most frequent in the ulcerative and papillary forms.

Occasionally specimens are observed in which there is marked reduplication of the columnar epithelium and a tendency towards a concentric arrangement of the cells, which somewhat resembles carcinoma. A similar arrangement of the squamous epithelium has been described, in which groups of cells are present which somewhat suggest cancer pearls. By a careful histologic examination the differentiations of these two conditions is always rendered feasible. The mitosis, hyperchromatosis, rapid proliferation, and penetrating character of the cancer cells and the absence of tubercles should make the differentiation possible in all cases.

Tubercle bacilli can frequently be demonstrated in smear specimens and almost always by animal inoculation, although in old cases mixed infections are of frequent occurrence and at times make the demonstration of the original type of infection difficult. As a result of the amenorrhea and uterine enlargement which results, cases in which a pyometra has been present have been mistaken for pregnancy. It is needless to state that a properly conducted examination should easily clear up such an erroneous diagnosis. The pus in the uterine cavity is usually yellowish and creamy in consistency and not infrequently contains cheesy particles and possesses a foul odor.

Histologic Examination.—However difficult the clinical diagnosis may be in these cases, the histologic diagnosis is usually easy. The well marked evidence of chronic inflammation, the necrosis, and lastly the characteristic tubercles and the frequent presence of tuberculous giant cells, clear up any doubts which may have existed. Histologically

the inflammatory exudate is characterized by the presence of small round cells and a few polymorphous leukocytes. In the ulcerative variety the inflammation is most marked at the edge of the lesion. In addition, there is loss of surface epithelium and of underlying tissue, the erosion being lined by necrotic material. The cervical glands in some areas may be destroyed or unrecognizable. The blood vessels are engorged. In the papillary type, polypoid or papilla-like projections are present, which are covered by squamous or cylindrical epithelium, according to their point of origin. In either event, the surface epithelium is prone to proliferation, although the individual cells may be more or less normal. The stroma of the outgrowths is composed of cervical tissue, and is usually infiltrated with chronic inflammatory products. Tubercles and giant cells in varying numbers are present.

Tubercle bacilli may be demonstrated in stained preparations in most cases, if a careful search is instigated. In some instances, however, they are few in number, and in these cases animal inoculation offers a means of positive diagnosis and should be employed in all cases in which doubt exists.

CORPOREAL ENDOMETRITIS

With the exception of the fallopian tube, the endometrium of the body of the uterus is the structure most frequently involved in tuberculous infection of the female genital tract. Careful study has shown that tuberculous endometritis is, like a similar infection of the tubes, much more frequent than was formerly thought before routine histologic examination of tissues removed at operations was generally practiced. Mayo³ states that tuberculous endometritis in the menstruating uterus is infrequent. This has not been our experience; nearly 80 per cent of our cases have occurred during active sexual age.

The disease exists in two well defined varieties—(1) the miliary and the (2) caseous or ulcerative.

The Miliary Variety.—In many specimens, at the seat of this variety of tuberculosis the macroscopic lesions are not marked and unless a histologic examination is performed, no suspicion of the presence of this type of infection may be aroused. The entire endometrium is by no means always involved. The infection may be blood borne, the primary and perhaps only genital lesion being in the endometrium; or the endometritis may be secondary to a salpingitis, either as a result of a direct infection by continuity from the tubal mucosa, or by contaminat-

tion due to leakage of the tubal contents through the uterine ostia of the tube. It is often difficult to determine which of these routes infection has followed. The tubes are generally involved. Endometritis, the direct result of a bacteriemia, is more frequent in the miliary variety than in the caseous, which latter is nearly always secondary to tubal lesions.

In advanced cases, the mucosa is reddened and thickened and hyperemic; the superficial tissue may contain small discrete yellowish or grayish semitranslucent elevations, which are tubercles. In some specimens the tubercles can be plainly discerned with the naked eye, while in others they are less conspicuous, and their presence may not be suspected until a histologic examination is made. The uterus is usually slightly enlarged and not infrequently tubercles can be seen upon the peritoneal surface. This is especially likely to be the case, if a tuberculous peritonitis has been present. An accompanying salpingitis is the rule. In rare instances, as a result of adhesions at the internal os, occlusion of the canal occurs and results in a pyometra. The pus under such circumstances is usually thick, creamy and yellowish in color, and may contain cheesy particles. Pyometra is rare, unless definite cervical lesions are present.

HISTOLOGIC EXAMINATION.—This presents a somewhat varying picture. In some specimens the infection is chiefly superficial, the deeper portions of the endometrium being comparatively normal. In its very early stages, tuberculous endometritis cannot be distinguished from other forms of inflammation (Schramm⁴). The inflammation begins upon the surface in the majority of cases (Orthman and Munson,⁵ Rosenstein⁶). This type of infection is usually acute, although specimens in the chronic stage are encountered. The mucosa, besides being thickened, is infiltrated with inflammatory products and contains more or less numerous tubercles, in many of which typical giant cells are present. Tubercles may generally be observed in varying stages of development, and are always interstitial in location. A more or less superficial involvement of the underlying myometrium is usually present, and in some uteri may be a marked feature of the specimen. The blood vessels of the mucosa are usually enlarged and the infection tends to spread along them and the lymphatic channels. Tubercle bacilli can frequently be demonstrated in stained sections in the tubercles, especially if the lesions are in the acute stage.

Caseous Variety.—In the caseous, or as it is sometimes spoken of, the cheesy or infiltrating variety, the macroscopic evidences of the disease are more marked and more characteristic. The uterus is usually somewhat enlarged, the tubes are likely to be involved, and tubercles

may be present upon the peritoneal surface. Although tubercles upon the peritoneum are of frequent occurrence, they are perhaps less often observed than in the miliary variety. Upon opening the uterus, the myometrium is often somewhat thickened and presents evidence of a chronic inflammation. The entire endometrial cavity may be filled with yellowish or whitish cheesy material, or part of the mucosa may be thickened and reddened and perhaps contain macroscopic tubercles, and other areas may be covered with caseous material. Tuberculous endometritis does not occur with uniform severity over the entire corporeal endometrium, but patches of disease are likely to be present, especially in those areas near the tubal ostia, and in all specimens in this location the lesions are prone to be the most advanced. Some areas are likely to be the seat of an advanced change, and others may continue comparatively normal. This characteristic is common to all forms of endometritis, whether tuberculous or otherwise, and has been emphasized by Hitschmann and Adler,⁷ by Strong,⁸ and by other observers. During the late stages of the disease, however, the entire endometrial cavity is, as a rule, involved. The superficial and even the deeper layers of the endometrium become necrotic, the endometrium is destroyed, and a marked involvement of the myometrium occurs. As a result of the destruction of the endometrium, amenorrhea is likely to result, and, viewed in conjunction with the uterine enlargement, has led to a mistaken diagnosis of pregnancy. One or more ulcers may be present; these are lined by necrotic tissue and often partially or entirely covered with cheesy material.

As a rule, in both this and the miliary variety of the disease, a tendency exists for the condition to limit itself to areas above the internal os, and in some of the specimens of the cheesy variety of infection, this characteristic is most striking. Only in comparatively rare instances is the cervix invaded.

HISTOLOGIC.—The histologic picture depends largely upon the stage of the disease. This variety is more prone to exhibit chronic changes than is the miliary form. The pathologic process may vary from a partial involvement of some portion of the mucosa to a total destruction of the entire mucosa, and more or less of the underlying myometrium. The surface is, as a rule, necrotic, and the deeper portions of the mucosa exhibit the changes common to a chronic inflammation. In tuberculous endometritis the chief changes are in the interstitial portions of the mucosa. The glandular epithelium apparently possesses a partial immunity. In some specimens observed by the author, a well marked proportion of the glandular epithelium has been present, and even a

tendency toward a squamous metaplasia has been observed. The epithelium, as a rule, although exhibiting the above mentioned tendency to withstand desquamation, by no means escapes inflammatory reactions, and in many instances the cells are enlarged, swollen, irregular in shape, lose their cilia, and exhibit well marked nuclear changes; the nuclei often are enlarged, nearly filling the cell, and stain irregularly, frequently deeply, and may possess well marked hyperchromatic qualities. The surface epithelium is lost before that of the glands, and in chronic cases may be replaced by granulation tissue. The distinguishing histologic characteristics of this, as of all tuberculous changes, is the tubercle. These are interstitial in location, show the usual epithelioid appearance and frequently contain tuberculous giant cells. These possess large distinct nuclei, which are often distributed with a certain regularity. The tubercles and inflammatory changes are by no means limited to the mucosa, the underlying musculature usually being more or less invaded. Indeed, in advanced cases no trace of the mucosa may remain, the surface being covered with a layer of necrotic tissue, beneath which is a zone of degenerating and inflammatory granulation tissue, and finally the inflamed myometrium. In still other specimens, necrotic myometrium actually lines the endometrial cavity.

Tubercle bacilli can generally be demonstrated in stained sections, if a careful search is instigated. In the acute stages, tubercle bacilli are usually present in considerable numbers and little difficulty is encountered in their demonstration. In chronic cases, the demonstration of the bacillus by staining methods alone is sometimes difficult, as the organisms are comparatively few in number and may possess atypical forms.

Myometritis.—As has been stated, a greater or less involvement of the underlying myometrium is of frequent occurrence in advanced cases of tuberculous endometritis. These uteri may be normal or somewhat enlarged. Beyond the fact that a salpingitis, usually bilateral, is generally present, no macroscopic evidences of infection are necessarily present. Adhesions over the peritoneal surface may be observed, and in some instances the serous coat is studded with tubercles. In a large proportion of specimens, however, nothing strongly suggestive of the variety of infection can be observed.

In tuberculosis perhaps more frequently than in any other inflammation calcareous deposits may be formed. These may occur as small flakes or as well defined bone-like particles. In some instances, as a result of inflammatory occlusion at the cervico-uterine junction, a pyometra occurs. In this case the body of the uterus is more or less sym-

metrically enlarged, and is likely to feel softer and suggest an ill defined sense of fluctuation. On opening the uterine cavity, the appearance of the endometrium may suggest tuberculosis. The myometrium is often thickened, and may be the seat of small caseous areas discernible to the naked eye.

HISTOLOGICAL EXAMINATION.—Upon histological examination, the endometrium almost invariably presents the changes previously described. The myometrium presents the usual evidence of inflammation either of the acute or the subacute or chronic type. In addition, however, tubercles are found scattered throughout the tissue. Many of these contain the typical tuberculous giant cells. As has been previously stated, the inflammation in the myometrium tends to advance along the course of the blood or lymph spaces or between the interstices of the myometrium. Actual intramural abscesses are occasionally present, but these in nearly all instances communicate with the endometrial cavity. The condition is nearly always secondary to endometritis, and as a result the inner layers of the myometrium are likely to be chiefly involved; in old chronic cases, however, even the outermost layer of the myometrium may be invaded. Tubercle bacilli are present, but their demonstration in the depths of the muscle is as a rule much more difficult than from the endometrium. Small cheesy particles should be selected for smear preparations, and in stained sections tubercles should be examined.

Intramural Abscess.—Intramural abscesses may be small or large, and single or multiple. They are present more frequently in the inner and central layers of the myometrium and less frequently in the external layer. As a general rule, the abscesses are distinctly secondary to infection of the endometrium. The pus is usually thick yellowish and often contains degenerated cheese-like particles. These abscesses are perhaps most frequent in the fundus of the uterus in the neighborhood of the cornua.

In rare instances, tuberculous abscesses of the myometrium have been observed in conjunction with normal endometrium. In 1840 Osiander⁹ reported a case in which there were nine or ten soft tumor-like masses present in the uterus. These were thought to be of tuberculous origin. In view of the ill defined knowledge of the pathology of genital tuberculosis at that period, and the rather meager description, this case must be looked upon with grave suspicion.

Madlener¹⁰ has reported the history of a case of secondary tuberculous infection of an adenomatous polyp, which he believes resulted from an entirely local caseous focus in the myometrium. Zahn¹¹ has

related a somewhat similar case of infection of a polyp from a tuberculous ulcer of the endometrium. Wassmer¹² reports from Runge's clinic in Göttingen six cases of tuberculosis, five of the endometrium and one in which there was an abscess of the myometrium. The latter case occurred in a sterile woman, 39 years of age. Wassmer states his belief that in this case the infection began from a diffuse tuberculous peritonitis, and from thence spread to the uterine musculature and later to the endometrium. The abscesses were moderately large and tumor-like in appearance. Gottschalk¹³ cites a case occurring in a virgin, 32 years of age, in which there was a circumscribed tuberculous process clearly intramuscular in location and separated from the endometrial cavity by healthy myometrium. Tuberculous adnexitis was present. Gottschalk believes this proves that tuberculosis can localize itself in the uterine muscles by way of the lymphatics. Papow¹⁴ cites the case of a multipara, 39 years of age, who, in addition to cervical and adnexal lesions, had an abscess in the anterior surface of the uterus, near the left cornu. Frome¹⁵ performed a vaginal hysterectomy upon a patient 41 years of age for profuse and repeated hemorrhages. Bilateral adnexitis and macroscopic tubercles in the endometrium were present. In the innermost layer of the myometrium existed numerous tubercles. An intramural abscess was found. Watkins¹⁶ reported the history of a case of an intramural abscess which occurred in a patient 43 years of age. The family history was negative for tuberculosis, and she was sterile. Five months before operation the patient fell and sustained an injury to the left side of the abdomen, low down. Pain continued for months. The patient was afebrile, but there was loss of weight and strength, and upon examination the condition simulated a uterine myoma. The uterus was enlarged to twice its normal size, and in the anterior wall there was a myoma-like intramural swelling. The adnexa and endometrium were normal. On section, the uterine lesion was found to be about 3 cm. in diameter, and was yellowish in color, friable, moist and caseous. No true capsule was present. The uterine focus was found to consist of confluent tubercles exhibiting the typical characteristics of tuberculosis. There was much advanced caseous necrosis and many miliary tubercles were scattered throughout the myometrium. No tubercle bacilli were demonstrated in sections, but the histologic diagnosis was confirmed by animal inoculation. The case was probably one of hemogenous infection; the primary focus was not, however, discovered. Roberts¹⁷ has reported an interesting case of diffuse tuberculosis of the uterus with abscess formation, which simulated a myoma. The patient was 49 years of age and single. Some time previously she had

been curetted for irregular bleeding. The curettings were not histologically examined. The hemorrhages recurred. The lungs were normal. Operation was decided upon. No tubercles were present in the peritoneum, the right tube had been converted into a pyosalpinx and the left into a hydrosalpinx. The uterus was irregularly enlarged and covered with adhesions. The uterine walls were thickened, and contained numerous areas of suppuration from which cheesy worm-like bodies could be squeezed. All the myometrium was more or less involved, but not markedly in the region of the cornua. The endometrial cavity was enlarged, the walls were necrotic and contained purulent material. Sections showed a diffuse tuberculosis, as instanced by numerous areas of caseous degeneration with epithelioid and giant cells. Apparently the same case has also been reported by Stewart.¹⁸ Alessandrie¹⁹ has reported the history of a somewhat similar case.

The following example of an intramural uterine abscess not communicating with adnexa or endometrial cavity has been observed by the author: Pathology, No. 4108; age 25 years; shortly after marriage, four years ago, a profuse purulent leukorrhea and symptoms of urethritis appeared, followed by a labial abscess. One child three years ago. The puerperium was complicated by pelvic peritonitis. Since then, sterility and occasional attacks of pelvic peritonitis. Examination on admission to the hospital showed a small tuberculous lesion at the right apex, and a moderately massive pelvic inflammatory disease. It was the latter condition that brought the patient to the hospital. Gonococci were demonstrated in the secretion from the cervix and from one of Bartholin's glands. A supravaginal hysterectomy and bilateral salpingo-oöphorectomy was performed. Convalescence was somewhat prolonged, but otherwise normal. The pathologic examination of the uterus and appendages showed them to have the usual appearances of pelvic inflammatory disease. The tubes were converted into pyosalpinges. The abdominal ostia were closed and no fimbria could be distinguished, nor were there any tubercles upon the peritoneal surface. One ovary was the seat of a small abscess, evidently the result of an infection of a corpus luteum; the other was enlarged, covered with adhesions, and contained a number of retention cysts. The uterus was normal in size, and in the left cornu, on the anterior surface, was a semifluctuant swelling 2.5 x 2 x 1.5 cm. Histologic examination showed this to be an intramural abscess, not communicating with the tube or endometrial cavity. No gonococci were demonstrated in either of the adnexa or in the intramural abscess. Numerous tubercles, many of which contained typical giant cells, were present in the tubes and in the intramural ab-

cess. This case appeared to have been one in which tuberculosis was implanted by hemogenous infection upon the preëxisting gonococcal lesions. Whether the intramural abscess was originally the work of the gonococcus, it is impossible positively to determine. This case has been previously reported by the author.²⁰

Tuberculous Deciduitis.—This condition may result from a preëxisting tuberculous endometritis, or the infection may occur subsequently to conception. The histologic picture naturally varies with the advancement of the pregnancy and the stage of the lesion. On macroscopic examination the decidua may be found thickened, or may be normal in depth. It is red, congested, and the surface is likely to present more or less evidence of necrosis and may be partially covered by fibrin, lymph, and caseous material. In some specimens described the decidua has appeared normal to the naked eye, and in others, although evidently the seat of an inflammation, no changes characteristic or even suggestive of tuberculosis have been observed.

HISTOLOGIC EXAMINATION.—Histologic examination shows that the chief changes produced in the decidua by infection with tubercle bacilli are necrosis of the tissue and thrombi in the venous sinuses. Typical tubercles and the formation of giant cells, so characteristic of tuberculosis in other parts of the female genital tract, do not occur in the decidua, although they may be present in the myometrium underlying the basal decidua, or less frequently a tendency toward the formation of ill defined giant cells may be observed in the deeper layers of the decidua. Tubercles are not formed from the decidua cells. Runge,²¹ in the first recorded case of tuberculosis of the decidua, commented upon the absence of tubercles and giant cells, and explained it upon the basis of the transient character of the decidua and its slight capacity for proliferation, the latter being proved by the rarity of tumors in the decidua. Warthin²² explains the phenomena by stating that the stroma cells in their transformation into decidua cells have already passed into an epithelioid form and are incapable of further proliferation under the action of such stimuli as tubercle bacilli. In the nine cases reported by Schmorl and Geipel²³ tubercles and giant cells were absent from the decidua in every case. Similar findings are observed by Wollstein,²⁴ Westenhöffer,²⁵ the author, and others. The degree of necrosis varies markedly in different cases, but this change is usually pronounced and, combined with the aforementioned thrombi, should in all cases put the pathologist upon his guard for this type of infection. The necrotic areas resulting from tuberculosis must be distinguished from the necrosis which is normally present in the placenta at times. In the lesions pro-

duced by tuberculosis, there is usually marked karyorrhexis of the lymphocytes and of the polymorphonuclear leukocytes, and in other specimens a well marked caseous degeneration, all of which points are absent in the normal placenta. In addition to necrosis and thrombi, the usual evidences of a deciduitis are present and are characterized by the production of an inflammatory exudate, composed of serum, small round cells, plasma cells and polymorphonuclear leukocytes, varying in intensity according to the stage of the disease. The stroma cells are often edematous and take the stains poorly. The cell outlines are indistinct and the nucleus stain moderately deep. The blood vessels are markedly congested. Even in the same specimen variations in degree of inflammatory reaction are often marked and are of frequent occurrence.

PLACENTAL TUBERCULOSIS

Macroscopic Appearance.—The presence of tubercle bacilli in a placenta does not by any means necessitate macroscopic or even histologic changes being present. Tuberculosis apparently exerts no influence on the size of the organ. Nearly all the tuberculous placentas which have been described have corresponded closely in this respect to the normal, and this has been our own experience in a fairly large series of cases. The area in which changes are most likely to occur is at the base near the insertion of the cord. In Wollstein's²⁴ case, a triangular area 5 x 7 cm. with the apex near the insertion of the cord was present. This area was yellow, soft and somewhat cheesy. This area of degeneration extended to and involved the membranous surface. In some reported cases a number of cheese-like areas have been observed. These vary in size. The maternal and fetal surfaces are often somewhat rougher than normal. In some specimens small elevations resembling tubercles have been observed. Smears from the degenerated cheesy areas show tubercle bacilli. The cord is as a rule normal. The uterus in these cases is apt to be slightly enlarged, flabby, and the peritoneal surface may show tubercles. Schmorl and Geipel²³ have described four varieties of placental tuberculosis: (1) On the periphery of the villi; (2) in the stroma of the villi; (3) in the basal decidua and (4) in the chorion involving also the amnion. Warthin²² classifies tuberculosis of the placenta as follows: (1) Decidual, (2) intervillous, (3) intravillous, (4) intravascular chorionic, and (5) chorioamniotic. This is practically the same as that of Schmorl and Geipel with the addition of the intravascular chorionic variety, which is due to the development of tubercle

bacilli in the blood vessels of the villi or chorionic stems, resulting in a primary lesion of the endothelium of the vessel, followed by secondary thrombosis. The later organization of the thrombus by epithelioid cells derived from the connective tissue of the vessel wall gives an intravascular tubercle. Of these five forms of tuberculosis of the placenta, the first is the most common and is especially apt to be observed in full term placentas. The second or intervillous lesions are frequent. Warthin²² described this variety as follows: Throughout the intervillous spaces there are small, round, deeply stained areas composed of firmly granular or hyaline substance, containing lymphocytes and polymorphonuclear leukocytes in varying stages of disintegration. The majority of these areas are about the size of a pin head, or somewhat smaller. They take the eosin stain more deeply than the hyaline fibrous masses which are formed normally in the intervillous spaces; but the fragmentation and diffusion of the nuclei of the leukocytes give to many of them a bluish tinge. In their general characteristics they resemble the hyaline thrombi of the decidual vessels. Varying numbers of tubercle bacilli are present, some in the thrombi as well as a few in the intervillous blood spaces. In single sections the tuberculous thrombi often appear lying between or adjacent to villi covered with syncytium, showing apparently no pathologic changes. In other instances they appear to be lying free in the blood spaces. Serial sections, however, show that in old cases the thrombi are attached to a villus at some point where the syncytium has either vanished or was present as a swollen hyaline layer devoid of nuclei. In many cases the necrosis of the syncytium presents a firmly granular appearance, suggestive of a beginning caseation. A similar change may be seen in some of the thrombi. In those cases in which the syncytium is absent and the thrombi are resting directly upon the stroma of the villi, the latter in many instances present evidence of epithelioid proliferation at the point of contact. In some instances epithelioid cells and typical Langhans' giant cells are present, extending from the stroma of the villus into the thrombi. Thrombi may be demonstrated, which are being organized by epithelioid tissue arising from the stroma of the villi and are thus changed into typical tubercles. Giant cells are, as a rule, numerous and large. In many thrombi the only evidence of epithelioid changes is found in solitary giant cells, and these, although apparently occupying the center of the thrombus, possess long protoplasmic processes continuous with the stroma of the villus. In those thrombi which rest upon necrotic syncytium no tubercles or giant cells are found. This tends to prove their origin from the stroma of the villus and not from the syncytium. The primary lesion

in the production of intervillous tuberculosis appears to be a degeneration or necrosis of the syncytium. Here an agglutinative thrombus forms, composed of leukocytes, red blood corpuscles, or blood plaques from the maternal blood. Epithelioid organization from the stroma of the villi next occurs and the tubercles thus formed later undergo caseation. Schmorl and Geipel²³ are of the opinion that the epithelioid cells originate either from lymphocytes or from the fixed cells of the stroma of the villi. Warthin²² emphasizes his opinion that the placenta has no especial protection against tuberculosis. In the event of tubercle bacilli gaining access to the maternal blood stream, the chances in favor of placental localization are, he thinks, as great as those of any other organ. This does not entirely coincide with the author's experiences, in that, in the large proportion of cases in which tubercle bacilli are present in the placenta, histologic changes were present only in a small minority.

Intravillous Tuberculosis.—Schmorl and Geipel²³ regard this type of tuberculosis of the placenta as very rare, having observed it but once in their series of specimens; in Warthin's²² cases, however, although not so numerous as the intervillous tubercles, the intravillous lesions were common. In this variety tubercles are present in the stroma of villi whose syncytium is normal and independent of intervillous thrombi, as shown in serial sections. The lesions present all the characteristics of tubercles, and giant cells may be present in various stages from the first localized necrosis to advanced caseation. The syncytium remains normal until the caseation reaches the subsyncytium layer of the stroma, after which the villus covering becomes necrotic and a thrombus forms at the site of the injured syncytium. Tubercle bacilli can usually be demonstrated without difficulty in the caseous lesions. Warthin very properly points out that the presence of intravillous tubercles in the absence of syncytial lesions must be considered as strong evidence that the bacilli have passed through the syncytium without damaging it, and have produced their characteristic changes first in the stroma of the villus. Further evidence pointing to this conclusion is the absence of thrombi upon the syncytium in the early stages. In addition, the fact that intravillous tubercles are present in cases in which there are no tubercles in the fetus would seem further proof of the above assertion, as it is not probable that the chorionic villi would alone show tubercles, if the dissemination occurred by metastasis directly through the fetal blood stream, while a retrograde metamorphosis seems still less likely. Schmorl and Geipel²³ offer the explanation that the entrance of tubercle bacilli may occur through a defect in the syncytium, or an infection from

the fetal blood stream through a direct metastasis after passing through the fetal body.

Intravascular Chorionic Lesions.—This is a rare lesion, but is probably similar to the foregoing in the method of formation. In this variety tubercles form in the same manner as previously described. These lesions occur in the vessels of the chorion. The thrombi may entirely obliterate the lumen of the vessel, or may partially occlude it. They are similar in appearance to the intervillous thrombi and are deeply staining hyaline or granular masses composed of broken up chromatin. The vessel walls at the site of the thrombi often show beginning necrosis. The epithelioid cells of the tubercles develop from the vessel walls. Warthin demonstrated tubercle bacilli in these thrombi.

Chorio-Amniotic Variety.—Warthin²² states that secondary involvement of the amnion by large caseating or epithelioid tubercles of the chorion was observed by him a few times. The portion of the amnion in the neighborhood of the chorionic tubercles was thickened, infiltrated with leukocytes, and showed a beginning caseation. Tubercle bacilli were demonstrated in the caseous area. Schmorl and Geipel²³ have described similar lesions. One or all of these varieties of tuberculosis may be present in a single specimen.

In one of the cases examined by the author some of the tubercles exhibited a well marked tendency toward healing. Similar changes were observed by Warthin²⁶ in a recently described case. Many of the tubercles in his case showed no caseation, or only slight central caseous changes. Tubercle bacilli could not be found in the healing tubercles, but were demonstrated in those which were caseous. Healing tubercles must be differentiated from infarcts, which can easily be accomplished by noting their circumscribed shape and by the fibroplastic proliferation of the villi induced in the primary intervillous thrombus, which forms a condensed mass of epithelioid cells. Warthin further calls attention to the need for differentiation from small localized areas of syphilitic chorionitis and small infarcts showing reparative changes. He states that in the former the syphilitic process involves only the stroma of the villi and the latter are not fused with the solid fibroplastic or fibroid mass; and in the healing infarcts the villi may be fused, but there is an absence of fibroplastic tissue, or only a small amount present. The healing tubercles may show the outlines of some villi fused into an intervillous epithelioid or fibroplastic proliferation. In all cases of doubt, the presence of tubercle bacilli in the smears or sections or, as a final step, animal inoculation will prove the character of the lesion.

Tuberculosis of the Fallopian Tubes.—The fallopian tube is the

most frequent area infected by the tubercle bacilli in the female genital tract. Jellett²⁷ states that tuberculosis of the fallopian tubes is the commonest form of tuberculosis in women, with the exception of the pulmonary variety. The susceptibility of the fallopian tubes to tuberculous infection is explained by Pozzi²⁸ on the ground that the mucosa of these organs offers a favorable nidus for infection in conjunction with the changes which occur at menstruation and is easily accessible to organisms from tuberculous peritonitis. It has been shown experimentally in animals that, if fine granules are injected into the peritoneal cavity, some of the material finds its way into the fallopian tubes and can ultimately be demonstrated in the discharge in the vagina. The infection may result from blood carried organisms and by direct extension, or infection may occur by way of the lymphatics, the most frequent form probably being a secondary infection from the lungs, although some investigators think infection by way of the peritoneum the most common. This certainly is not infrequent. On the other hand, a hemogenic or other form of infection of the tubes may be followed by a general peritonitis. Direct extension from the endometrium may occur, but the converse is more common. Direct extension may also result from adherent foci, such as tuberculous lesions in the intestines, but here again the converse may occur.

For the purpose of pathologic study tuberculous lesions of the fallopian tubes may be classified under the heading of perisalpingitis, salpingitis, pyosalpingitis and hydrosalpingitis.

Perisalpingitis.—This variety of lesion is not infrequently the result of a secondary infection from the peritoneum. Tuberculous infection of the serosa of the fallopian tubes without involvement of the deeper coats is by no means frequent, and, although many specimens are observed which, upon macroscopic examination, present no pathologic changes except adhesions, histologic examination will usually reveal definite involvement of the muscularis or mucosa or of both. In perisalpingitis the tubes are as a rule normal in size, the abdominal ostium open, and the surface shows adhesions. The adhesions may cause considerable distortion of the tube while in situ, but after removal the lesions are less pronounced. Macroscopic tubercles may or may not be present in the serosa. Their presence is, however, usually an indication of an involvement of the deeper coats of the tube.

Histologically these tubes present no lesions beyond the above mentioned adhesions, and characteristic tubercles are comparatively infrequent, a number of sections not infrequently having to be examined before the etiology of the condition can be determined.

Salpingitis.—As a rule the mucosa is the first portion of the tube attacked, and from thence the infection spreads until finally all the coats are involved, the ampulla being generally the first part of the tube to be invaded. A study of the specimens in the gynecological laboratory of the University of Pennsylvania shows that slightly less than 50 per cent of cases of tuberculosis of the tubes were suspected prior to the histologic examination, and this despite the fact that all specimens are subjected to a macroscopic as well as a histologic examination. In Williams's ²⁹ report only 25 per cent were of the suspected variety. The presence of tubercles on the peritoneal surface of the tube, the fact that in this form of infection the abdominal ostium is more prone to remain patulous than in any other variety of infection, the presence of cheesy material within the lumen or adherent to the fimbria at the abdominal ostium, and the fact that these lesions are seldom seen in their early stages, the usual bilateral characters of the infection, are all points that should make the examiner suspicious of tuberculosis. The tendency toward patency of the external abdominal ostium in tubes, the seat of this variety of infection, is most marked. Although contractures at this point are frequent, actual occlusion, as compared with other varieties of tubal inflammation, is unusual, and even when the external end of the tube is entirely closed, the fimbria can usually be seen plastered down over the closed off end of the tube, a condition that is rarely present in lesions the result of organisms other than the tubercle bacilli. In one form of tuberculosis small nodules are present, especially in the isthmus of the tube, somewhat resembling at first glance a small fibroma. This variety is spoken of as a salpingitis isthmiae nodosa. In the early stages tuberculous salpingitis does not as a rule present very acute symptoms, and indeed is usually prone to run a somewhat chronic course, so that in this form of infection subjective symptoms are apt to be less marked than in the gonococcic or streptococcic varieties, and as a result specimens are rarely seen in the early stages. An exception to this is sometimes observed in autopsy specimens and in late infection from miliary tuberculosis. The above comprise the chief diagnostic features of tuberculosis of the fallopian tubes; although none are positive they are extremely suggestive of this form of infection. In about one half the specimens nothing even suggestive of tuberculosis can be detected by macroscopic examination alone, the tubes in these instances resembling organs the seat of ordinary inflammatory lesions. For this reason statistics regarding the frequency of tuberculosis of the fallopian tubes are likely to be misleading, unless based upon histologic as well as macroscopic examination.

Tubes the seat of tuberculous infection vary widely in appearance. Except in salpingitis isthmiae nodosa, the ampulla is the portion of the tube in which the pathologic process is most marked. The tubes may be normal in size or greatly enlarged. Violet³⁰ has especially called attention to the hypertrophy of the tubes which may result from tuberculous infection. The surface is usually the seat of numerous adhesions, and as the disease is prone to be chronic, these are likely to be dense. In the late stages or in those cases that are secondary to tuberculous peritonitis, macroscopic tubercles are often discernible. Caseous material is sometimes present at the external abdominal ostium, and is often observed adherent to the fimbriae; in advanced cases the entire peritoneal surface may be coated with yellowish gray cheesy material. The peritoneum covering the tube is red and inflamed. Similar changes may be observed on the surface of the uterus and ovaries. On section, the walls of the tube may be found much thickened; in other specimens the walls may be normal in depth. The lumen, unless the abdominal ostium is closed, is, as a rule, not greatly enlarged. The mucosa is generally thickened and congested, but as a result of necrosis may be entirely absent. In some specimens, as a result of thickening of the mucosa, the lumen is greatly reduced in size, and on section presents somewhat the appearance of the ordinary pseudofollicular hydrosalpinx. The lumen may be macroscopically empty, or may contain creamy pus, cheesy material, or watery fluid. The muscularis is generally thickened and edematous. Occasionally the tuberculous process has apparently been somewhat checked and retrogressive changes are observed. Restoration to the normal is, however, less frequent in tuberculosis than in other forms of infection. In this, as in all forms of adnexal tuberculosis, calcareous deposits are sometimes present, perhaps more frequently in tuberculosis than in any other variety of infection.

In salpingitis isthmiae nodosa the tubes may be normal in size or may be somewhat elongated and slightly enlarged in diameter. This form of tuberculosis does not, however, usually result in massive lesions, the chief feature being that small firm fibrous nodules are present, chiefly in the inner and middle third of the tube; these vary from slight enlargements to small tumor-like masses one or two or even more centimeters in diameter. On section through one of these nodules they are found to be firm and fibrous in consistency; the lumen of the tube, which may pass through the center or eccentrically, is reduced in size, often being no larger than a pin hole. What appear to be multiple lumina are often observed; histologic examination of these, however, shows that they are pseudoglands.

Bell³¹ recognizes two forms of tuberculosis of the fallopian tubes, the miliary and the caseous; but while well defined instances of these forms are often observed, more frequently this is not the case.

Pyosalpinx.—This as a rule represents the end stage of a salpingitis. In those cases in which the abdominal ostium finally becomes closed, resulting in a pyosalpinx, the fimbria can usually be observed plastered over the closed end of the tube. The actual method of closure of the external abdominal ostium is still somewhat in doubt. Doran,³² Kleinhaus,³³ Opitz,³⁴ Reis,³⁵ and Young³⁶ have devoted papers to a description of the manner of closure of pyosalpinges in general. The last named observer summarizes the various theories as follows, dividing them into two classes: Class I includes those theories based upon the increase in the total length of the tube wall, which, by expanding in an outward direction, becomes projected beyond the tubal fimbria. According to the theory of Doran and Kleinhaus, the increase in length is dependent on the swelling and increase in the substance of the tube wall, associated with the inflammation. Reis believes the gliding outward of the "peritoneal ring" over the fimbria is rendered possible by the fact that the walls are loose and redundant subsequent to the collapse of the distended tube. In Class II are included the theories of Opitz and Young. The first explains the process as due to retraction of the muscularis and mucosa of the tube within the serous coat; and the latter claims that the gliding process involves only the inner coat of the muscularis. The so-called perimetritic closure of Doran is explained by the matting together of the fimbria by inflammatory adhesions without preliminary recession. In many instances the intramural portion of the tube probably becomes occluded somewhat earlier than does the external abdominal ostium. This occlusion is the result of agglutination of the mucosa. In some cases this becomes permanent, whereas in others leakage occurs at irregular intervals. In some specimens the occlusion at the inner portion of the tube is largely mechanical, as a result of a kink or bend. The above applies to pyosalpinges in general.

Serial sections have been made by the author through the occluded outer end of a number of tuberculous fallopian tubes. From this study it would appear that the fimbria of the tube is attacked early in the disease and that, as a result of infection, it becomes first swollen and then often adherent to the peritoneal coat of the tube, and that, as subsequent closure occurs, the swollen and adherent fimbria being attached outside the tube, cannot be withdrawn inside the lumen, thus accounting for the frequency with which the fimbrias are observed plastered externally on the occluded ends of tuberculous pyosalpinges. The facts that tuber-

culosis usually attacks the outer end of the tube primarily, and that the onset is often chronic, probably account for the greater frequency with which the fimbria are visible in tuberculous than in other varieties of pyosalpinges.

Pyosalpinges of tuberculous origin vary markedly in size, but in some instances grow to enormous dimensions. Some of the largest tubal abscesses which the author has seen have been of this variety of infection. The surface is usually more or less covered with adhesions, and this is apt to be especially pronounced in those cases which are secondary to a tuberculous peritonitis. The walls vary much in thickness, but as a rule in very large specimens they are moderately thin. This tendency for the walls to be thin in large pyosalpinges is perhaps more marked in the tuberculous than in other types of infection. Indeed, in gonorrheal pyosalpinges it may be stated that the thickness of the walls has practically no relation to the size of the lumen.

Not infrequently a pyosalpinx may be present on one side and a salpingitis on the other. The lumen in advanced cases is usually necrotic, covered with cheesy material, and what mucosa remains is red and inflamed. The contents of the lumen varies; it is often caseous material, or may be thick creamy pus, sometimes blood streaked; more rarely the pus is moderately thin and dark in color.

Hydrosalpinx.—As the result of a tuberculous infection of the tube, hydrosalpinx occasionally occurs. In these specimens the walls tend to thin out, and the infection is not as a rule active. The usual type of hydrosalpinx is the pseudofollicular variety. The mucosa is generally thickened, the actual lumen often being small, and the tube presents on cut section a honeycombed appearance, the compartments varying considerably in size, but generally being small. The contents are thin, watery material, sometimes colorless, but more often presenting a slightly yellowish or amber tint. Tubercle bacilli can rarely be demonstrated in these specimens, whereas in the tube, the seat of a purulent collection, the specific organism can often be found with no great difficulty.

Histologically, tubes the seat of this variety of infection present the usual evidence of an inflammatory infiltration, generally chronic in character, plus the characteristic tubercles, some of which will be found to contain giant cells. The tubercles are not limited to the mucosa, but may also be present in the muscularis. In the absence of bacteriologic proof, the presence of tubercles is the only characteristic of this variety of infection upon which a positive diagnosis can be based. Certain other characteristics exhibited by tuberculosis are extremely suggestive. Necrosis of the mucosa, sometimes amounting to an entire absence of this

layer of the tube, is of frequent occurrence, and is found perhaps more often in this infection than in tubes the seat of an ordinary pyogenic invasion. A form of tubal tuberculosis which is not infrequent is that in which the tips of the mucosa folds are agglutinated, forming numerous pseudo glands. These vary in size and shape, but are usually moderately small. The epithelium is not desquamated, but on the contrary exhibits a well marked tendency toward reduplication, sometimes as many as four or five layers being present in some areas. Together with the reduplication, the individual cells are themselves altered and present more or less irregularity, alike as to size, shape, and staining properties. Often the nuclei are hyperchromatic and occasionally exhibit karyokinetic changes. At first glance, especially in the absence of tubercles or giant cells, such an appearance is strongly suggestive of carcinoma. A more careful examination, however, dispels this theory, whereas the epithelial cells are reduplicated and somewhat irregular and possess deeply staining nuclei; they are not of the cancer type, nor is there any penetration of the basement membrane. To dissipate any further doubt, a search through a number of sections is almost sure to reveal one or more characteristic tubercles. A few instances (Lipschitz,³⁷ Saulman³⁸) have been recorded in which tuberculosis and cancer have been present coincidentally in the same tube. The previously described lesions can, however, be easily differentiated by the experienced pathologist from carcinoma. The tubes in which this condition has been observed by the author are usually of moderate size and the external abdominal ostium may or may not be closed. Barbour and Watson³⁹ and others have reported cases of this type, and have observed penetration of the muscularis as a result of proliferation of the epithelium, as well as the formation of strands and masses of epithelium in the substance of the mucosa. Evidence of destruction of the surface epithelium is also present. In forms other than the caseous variety, and excepting the presence of tubercles and tuberculous giant cells and bacteriologic evidence, proliferation of the epithelium of the mucosa is one of the chief characteristics of tuberculosis in this area. In the pseudocancerous variety there is little or no tendency toward desquamation, even when the disease is advanced.

The epithelium cells may enlarge or lose their cilia. The nuclei swell and often occupy almost the entire cell.

In the chronic stage of tuberculous salpingitis, there is often an excessive formation of connective tissue, and calcareous formation is not uncommon.

TUBERCULOSIS OF THE OVARY

The ovary possesses a well defined resistance to infection by tubercle bacilli. Indeed, until comparatively recent years tuberculosis of this organ was looked upon as a gynecologic rarity. As late as 1880 Brissand⁴⁰ stated that there was not a single example of this condition in the museum of the College of France. When it is remembered how frequent is tuberculosis of the fallopian tubes, and that this infection is a hematogenous one in the large majority of cases, and the close anatomic relationship between the tube and ovary, it is surprising that the latter is not more frequently attacked, especially as it is the ampulla of the tube which is usually primarily invaded. Whereas a true infection of the substance of the ovary is not the rule when the tubes are involved, peri-oöphoritis of tuberculous origin is quite frequent.

Peri-oöphoritis.—This tuberculous affection of the ovary by no means indicates an actual invasion of the ovary by tubercle bacilli. These lesions are generally secondary to tubal tuberculosis, but may be the result of a general tuberculous peritonitis. In either event, they are caused by a deposit upon the surface of the ovary of a tuberculous exudate, which results in more or less thickening of the tunica albuginea and in adhesions to adjacent structures, usually the posterior layer of the broad ligament, the external end of the tube, the omentum, or intestine. Upon section, the ovarian substance is usually found normal and developing follicles are generally present. As a result of the thickening of the capsule of the ovary, a tendency toward the formation of retention cysts occurs and one, or more, of these is likely to be present, if the condition has been of long standing. The cysts are usually not large, and the ovary itself is generally nearly normal in size. This disposition of the ovarian structure to remain free from infection, even after prolonged contamination of the surface, is of importance in deciding upon the type of operation to be performed upon patients the incumbents of tuberculous salpingitis.

Oöphoritis.—In comparison with the preceding condition, this is a comparatively rare lesion. It is probably usually a hematogenous infection, although the possibility of invasion from the surface of a previously contaminated ovary at the time of rupture of a graafian follicle must be considered. As seen in the laboratory or upon postmortem, the infection is usually in the chronic stage, and the ovaries are, as a rule, but little enlarged. Retention cysts are, however, of frequent occurrence, and are usually of the follicular variety. The surface of the organ is

generally more or less covered with adhesions, and the capsule somewhat thickened. The substance of the ovary may be slightly firmer than normal and somewhat congested, but otherwise no marked macroscopic lesions are usually present. Less frequently, the ovary is enlarged and may contain one or more abscesses, the contents of which are cheesy material or creamy pus. These abscesses may be interstitial in type or may result from the infection, either hematogenous or from without, of either a graafian follicle or corpus luteum.

Histologically, the surface of the ovaries presents dense adhesions, which are generally quite avascular. The capsule is more or less thickened, not always uniformly. The ovarian stroma is infiltrated with chronic inflammatory products, small round cells, plasma cells, a few polymorphous nuclei, leukocytes and exudate. Often the stroma is edematous. The blood vessels are as a rule congested. Tubercles and tubercular giant cells are here and there present. These are usually sparsely distributed, and a number of sections may have to be studied before the characteristic lesions of this type of infection are detected. As will be observed, ovaries the seat of tuberculosis present no diagnostic characteristics, with the exception of tubercles. When abscesses are present, these possess a lining of caseous or necrotic material. Typical tubercles and giant cells are generally present in moderate numbers in such specimens. Tubercle bacilli can, as a rule, be demonstrated only with difficulty, except in acute or very advanced lesions.

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CHAPTER IV

CONGENITAL AND PLACENTAL TUBERCULOSIS

Placental transmission of tuberculosis—Conflicting reports of findings—Types, acute, chronic; errors in technic—Definition of congenital tuberculosis—Discrimination between congenital infection and congenital predisposition—Etiology—Germinative infection: Spermatozoic—Variety of infection—Experiments of Waldstein and Ekler—Observations of medical experts—Unfertilized ovum—Ovarian infection and germinal transmission of disease—Congenital germinative tuberculosis—Placental and fetal tuberculosis—Susceptibility—Opinion of Baumgarten and others—Tubercle bacilli in the blood stream—Histology and physiology of the placenta in relation to routes of transmission of tubercle bacilli—Views of Delore and other investigators—Infarcts described by Williams—Results demonstrating congenital or placental tuberculosis—Distinction between placental infection and fetal involvement—Criticism—Period at which intra-uterine transmission occurs—Predisposing factors to placental or congenital tuberculosis—Undoubted cases—Anatomical changes and presence of tubercle bacilli—Histologic changes and presence of tubercle bacilli—Demonstration of bacilli by staining or by inoculation of animals—Conclusions.

The subject of the placental transmission of tuberculosis and of placental pathologic lesions, the result of this infection, is of especial interest. Quite contradictory findings have been reported regarding the frequency of placental tuberculosis. Thus, Schlimpert¹ reported having found placental tuberculosis in 80 per cent of a series of cases; Novak and Ranzel,² in 70 per cent; Schmorl and Geipel,³ in 40 per cent. Pankow,⁴ on the other hand, in a series of 20 placentas, failed to demonstrate a single case, and Bossi had a similar experience. As a result of these and other equally conflicting reports, it has seemed advisable to gather and study the results secured in an extensive series of cases, with the hope of throwing some light upon the actual frequency of placental and congenital tuberculosis. At the outset it became apparent that the divergent results obtained by various investigators were dependent chiefly upon three factors: (1) The standard set for the tubercle bacillus—whether the staining of acid fast bodies morphologically similar to the tubercle bacillus was to be accepted, or whether inoculation, culture, or histologic changes were to be demanded before determining the exciting cause; (2) the different types of cases from which material was obtained—acute and chronic; (3) errors in technic.

CONGENITAL TUBERCULOSIS

Tuberculosis was probably recognized many hundreds of years prior to the Christian era (Williams,⁵ Osler,⁶ Waldenburg,⁷ Predöhl⁸ and Johne⁹). Hippocrates (460-376 B. C.), Galen (200-131 B. C.), and Celsus (30 B. C.) described the disease, and to-day the mortality statistics show that, of all deaths, from nine to twelve per cent are due to this affection (Rosenau¹⁰). It is not strange, therefore, that the etiology of so ancient and wide spread a scourge as tuberculosis should have received careful study.

It was early observed that the children of tuberculous parents were much more frequently attacked by the disease than were the offspring of healthy progenitors. Prior to the discovery of the tubercle bacillus by Koch in 1882, the theory that tuberculosis was of congenital origin received much consideration. Subsequently, however, the belief began to lose ground, and the frequency with which tuberculous offspring were born of infected parents was explained by the doctrine of postnatal infection, aided, perhaps, by a hereditary predisposition. That the majority of cases are thus caused has been proved beyond doubt. Recent investigations, however, by Schmorl and Geipel,³ Novak and Ranzel,² Sitzenfrey,¹¹ Warthin and Cowie,¹² and others tend to show that not only does congenital tuberculosis occur, but that it may be relatively more frequent than is generally assumed.

Definition.—The name “congenital tuberculosis” should be reserved for those cases in which tubercle bacilli are present in the fetus at or prior to birth. A sharp discrimination must be made between congenital infection and congenital predisposition. Numerous attempts have been made to classify infection of the embryo or fetus. Martius¹³ has strongly emphasized the distinction between the terms “congenital” and “inherited.”

He applies the term “congenital” to any condition that may be present in the child at the time of its birth, and the term “inherited” only to that condition which develops as the direct result of the conjugation of the two sex cells; in other words, anything that is given to the new organism from the germinative plasma. The terms “congenital” and “inherited” are somewhat confusing. It would seem advisable to use the term “congenital” to cover both varieties of infection, and, in these cases in which it may be necessary to differentiate between the two forms, to use the term “germinative” as descriptive of an infection caused by the spermatozoön or ovum—the germinative cell—applying the denomina-

tive intra-uterine or placental infection to those cases having hematogenous or other intra-uterine or placental origin.

Etiology.—Congenital tuberculous infection may occur in a number of ways; it may be due to the spermatozoon or the ovum—the germinative infection; or the products of conception may subsequently be infected as the result of a maternal bacillemia; or it may be the result of a direct extension from surrounding structures, either by continuity or through adjacent lymph channels.

Most authorities agree that tubercle bacilli are present in the blood stream under certain conditions, especially in the acute miliary form of the disease and in the terminal stages; that they are probably not constantly present, are frequently few in number, are generally difficult to demonstrate, and that slight errors of technic may lead to erroneous conclusions (Rump,⁵⁸ Liebermeister,⁵⁹ Gürner,⁶⁰ Dressen,⁶¹ Gobel,⁶² Klemperer,⁶³ Kahn,⁶⁴ Kessler,⁶⁵ Bacmeister,⁶⁶ Vinogradoff,⁶⁷ and others). The writer believes, with Fraenkel,⁶⁸ that the microscopic examination of the blood for tubercle bacilli is likely to prove misleading, and that the inoculation of animals is the only possible means of arriving at correct conclusions. Of 22 persons examined by Fraenkel, only two gave positive results. Elsasser⁶⁹ tested 41 cases of advanced tuberculosis, and was able to demonstrate the microorganism in 7.3 per cent of cases. Bogason⁷⁰ recovered the organism in only two of 41 patients, although he employed 10 c.cm. of blood. The work of Massel and Breton recently reported by Calmette⁷¹ is of especial interest in this connection. These investigators found that tuberculosis could be produced with relative frequency by the direct transfusion of blood from a tuberculous to a healthy guinea pig. By this method it was possible to transmit tuberculosis quite frequently, even from animals in whom the disease was chronic or the lesions comparatively small.

Pregnancy is prone to light up a latent or chronic tuberculosis, and thus produce a condition in which a bacillemia is likely to be present. Secondary infection and metastasis occur in the placenta in the same manner in which they affect other portions of the body. Dardeleben goes so far as to assert that the placenta is the locus minoris resistentiae of the gravid woman.

GERMINATIVE INFECTION

Spermatozoic.—Tubercle bacilli have never been demonstrated within the spermatozoon. In order to produce infection, however, it is not necessary for the bacilli to invade the spermatozoa, for a tubercle

bacillus adherent to the outer surface of the cell may effect a similar result. A tubercle bacillus may become attached to a spermatozoön at any point along its course—testicle, vas deferens, prostatic fluid, urethra, external surface of penis, vulva, vagina, cervix, uterus, or even the fallopian tube. It is, therefore, theoretically possible for an ovum to become infected by a spermatozoön, the tubercle bacillus having originated in the woman or been derived from an exanthropic source.

That spermatozoa may be the germ carriers in diseases other than tuberculosis, has been demonstrated (Bab,¹⁴ Sakurane,¹⁵ Fouquet,¹⁶ Feuillee,¹⁷ and others), and although the likelihood of such an event occurring varies markedly in the different diseases, the possibility of their being the carriers of tuberculous infection must be considered. The presence of organisms other than the tubercle bacillus in or attached to the spermatozoön does not always inhibit the activity of the latter.

In considering the variety of infection, the experiments of Waldstein and Ekler¹⁸ are of interest. These authors report that in normal rabbits the biologic tests appeared to show that in the female organism absorption of the spermatic fluid occurs. This observation will, however, require further verification.

Tuberculosis of the male genito-urinary tract is by no means infrequent. Viet¹⁹ and Martin²⁰ assert that involvement of the genital tract occurs in three per cent of tuberculous males. Guiteras²¹ reports that, next to the gonorrheal, the tuberculous variety is the most frequent form of epididymitis. When tuberculosis of the genital or urinary tract is present, the semen frequently contains tubercle bacilli; on the other hand, in some cases, notably in that of D'Aubeau,²² the discovery of the tubercle bacillus in the semen and the absence of lesions in the genito-urinary tract were the first evidences of the existence of pulmonary phthisis. Jani²³ and others have reported the finding of tubercle bacilli in the testes of phthysical men in whom no demonstrable genital lesions were present. Jani found the bacillus present in 5 of 8 cases examined. Sirenæ²⁴ injected the semen from a tuberculous patient into dogs, which then developed tuberculosis. Solles²⁵ and Foa²⁶ report similar results. Spano,²⁷ in six cases of phthisis, demonstrated the presence of tubercle bacilli in the seminal vesicles in five. Jackh²⁸ likewise demonstrated the presence of tubercle bacilli in the testicular secretion in two cases of acute miliary tuberculosis. Somewhat similar results were also obtained by Löwenstein.²⁹

Theoretically, tubercle bacilli free in the blood should not gain access to the testicular or prostatic fluid, but should become enmeshed in the

fine capillaries leading to the glandular structures of the testes or prostate; Grawitz,³⁰ however, showed that the mold germs, which have a larger diameter than tubercle bacilli, may under certain conditions reach the testicular secretion by way of the blood stream. Murphy³¹ calls attention to the fact that it is extremely difficult, in some cases, to make a diagnosis of tuberculous seminal vesiculitis, and that probably many of the cases in which the genitalia have been considered normal have in reality been instances in which this focus has been overlooked.

The work of Rohlff³² and Westmayer³³ tends to support Murphy's opinion, in that these investigations have demonstrated that tubercle bacilli are rarely present in the semen of phthysical men, if genital lesions are absent. Rohlff inoculated goats and rabbits with the spermatic fluid obtained from ten men who had died of pulmonary tuberculosis, with negative results. Westmayer injected the ground up particles of the testicles of similar subjects into the peritoneal cavity of rabbits, with like results.

Dobroklonski,³⁴ by means of smears and inoculations, tested the semen of 25 men who had died of pulmonary phthisis. Twenty-four were negative, the one positive result being obtained from a subject in whom a tuberculous epididymitis was present. Walther³⁵ examined 161 sections made from the testes, epididymes, and prostates of 12 phthysical subjects, without finding a single tubercle bacillus.

Gartner³⁶ injected a pure culture of tubercle bacilli into the testes of 22 rabbits and 21 guinea pigs; he then mated these animals with 65 females. In none of the 29 rabbits or 45 guinea pigs which were born did tuberculosis develop, except in one, the infection in this case probably being caused by food. Cornet³⁷ was unable to demonstrate the presence of tuberculosis either microscopically or by culture methods in 32 fetuses and young animals bred from guinea pigs the male parents of which had been inoculated in the testes, prior to breeding. Numerous instances are on record in which fetal tuberculosis has been produced experimentally in animals by injecting cultures of tubercle bacilli into the vagina just before or immediately after coitus (Friedman,³⁸ Varaldo,³⁹ and others). These results are, however, valueless, for a maternal infection followed by a hemogenic infection of the products of conception was probably the etiologic factor.

A tuberculous ulceration of the penis may also be the means of introducing tubercle bacilli into the vagina with the semen. Cornet mentions the possibility of tubercle laden sputum being used as a lubricant during coitus, with resulting infection. From what has been said it

would seem fair to assume that although germinative congenital tuberculosis of spermatozoic origin may occur, it is extremely rare.

Unfertilized Ovum.—Infection of the ovum may take place in the ovary, either before or after rupture of the graafian follicle, in the peritoneal cavity, fallopian tube, or even in the uterus, although it is generally accepted that fertilization of the ovum usually takes place in the fallopian tube. As in the spermatozoic infection, the tubercle bacilli may be either in or attached to the ovum; in the latter event it may subsequently gain entrance with the fertilizing spermatozoon or very shortly afterward. The decidua reflexa is probably formed almost immediately after the entrance of the fertilized ovum into the uterus, so that the event last intimated is extremely unlikely.

Sitzenfrey,¹¹ in one case, found tubercle bacilli situated in a primordial follicle of a human ovum. The patient was eighteen years old, and four years previously had had a peritonitis, presumably of tuberculous origin. At operation both adnexa were found to be tuberculous. Schottländer⁴⁰ has produced tubercles and giant cells experimentally within developing graafian follicles in rabbits. Landouzy⁴¹ believes that in rare instances infection of the ovum from a tuberculous oöphoritis or salpingitis may occur. That intra-ovarian infection of the ovum does take place has been definitely proved, but that extra-ovarian infection occurs rests only upon a theoretic basis. It is doubtful if an ovum infected within the ovary, if fertilized, could develop. Ova infected outside the ovary would naturally possess a slightly greater chance of developing.

Ovarian infection and germinal transmission of disease have been demonstrated by Rettger's⁴² investigation of bacillary white diarrhea in the common domestic fowl. Chicks which survive frequently become permanent bacillus carriers, the ovary being the important seat of infection. The eggs from such carriers often harbor the organism of the disease in the yolk, and chicks from these eggs are congenitally infected.

The fact that when intra-ovarian infection does occur, the fallopian tubes are usually involved, and are often occluded, may to a certain extent prevent the more frequent fertilization of such ova. That the ovum may be infected by microörganisms other than the tubercle bacillus has been amply proved (Hoffmann and Wolters,⁴³ Levaditi and Saurage,⁴⁴ Bab,⁴⁵ Magalhaes,⁴⁶ Koch,⁴⁷ Simmonds,⁴⁸ and others).

Congenital Germinative Tuberculosis.—From what has been stated it may be seen that germinative tuberculosis may take place in three ways: (1) the tubercle bacilli may enter the ovum with the fertilizing spermatozoon, either attached to the surface of, or actually within,

the male germinative cell; (2) the tubercle bacilli may be lodged within the ovum, which is later fertilized; (3) or the tubercle bacilli may have been attached to either the spermatozoön or the ovum and gain access to the latter shortly after fertilization. The question as to whether an infected fertilized ovum would develop is open to grave doubt.

We are willing to admit that, theoretically, germinative infection may occur; but viewed from a practical standpoint, this form of tuberculous infection is probably too rare to be seriously considered as a factor in congenital tuberculosis. Further investigation of this subject is necessary, and a careful study of the embryos and early gestation sacs of tuberculous parents would doubtless yield much information. The demonstration of a germinative infection is obviously extremely difficult, and most authors agree with Cornet that its existence has not yet been proved.

PLACENTAL AND FETAL TUBERCULOSIS

It is a generally accepted fact that fertilization of the ovum takes place within the fallopian tube—probably in its outer portion—and that from this point it is carried along by the action of the cilia of the surface tubal epithelium to the uterine cavity, where it becomes implanted. It is possible, therefore, for tubercle bacilli to enter the fertilized ovum at any point along its course. Obviously, the uterus is the most likely point for infection to take place. This may occur by four different routes, (1) hematogenic; (2) lymphogenic; (3) by direct extension through continuity; and (4) by tubercle bacilli gaining access from without.

Susceptibility to Tuberculosis.—It would seem advisable, at this point, to digress and to discuss briefly the action exercised by the maternal toxins and antibodies upon the presumably hitherto uninfected products of conception. This subject has received much attention and been widely discussed by Hollos,⁴⁹ Rosenau and Anderson,⁵⁰ Huppe,⁵¹ Bartel,⁵² Klebs,⁵³ and many others, and the question as to whether the embryo, fetus, or child of a tuberculous mother is hyposusceptible or hypersusceptible to the action of the tubercle bacilli is still in doubt. When we consider how susceptible the fetus is to the maternal tuberculous toxins, it would seem that the general nutrition must become impaired.

Carriere⁵⁴ showed experimentally that in animals tuberculous toxins influenced pregnancy by reducing the number of the offspring, and that in many instances these died *in utero* or shortly after birth, or that those that survived were weak. The effects were most marked when toxins

from both parents were injected. This investigator believed that the surviving young animals were more susceptible to tuberculous infection than were the control animals. Ballantyne states that, once the tubercle bacilli have gained access to the fetal tissues, they find there an excellent soil for development. Pankow⁴ inoculated a number of guinea pigs with portions of placentas obtained from twenty cases of suspected or congenital tuberculosis. Three of these pigs died within a few days, presumably from a toxemia, for in none of them was it possible to demonstrate the presence of tubercle bacilli.

Bossi⁵⁵ injected the ground up particles of placentas of tuberculous women into guinea pigs, and found that marked evidences of toxemia resulted. The effects were more lethal when placentas from women far advanced in tuberculosis or in poor general health were used, and in those from patients who showed large numbers of tubercle bacilli in the sputum. Control experiments with eight placentas coming from healthy women gave negative results. Bossi, therefore, concludes that there are in the placenta of tuberculous women toxins that are transmitted to the fetus and that may cause death or miscarriage, or result in the birth of weaklings. Cornet's³⁷ views agree with those of Bossi, and he believes that the toxins result from a process of osmosis. He does not, however, consider that such toxins increase the susceptibility to tuberculosis, but, on the contrary, he believes that the fetus in utero acquires a certain amount of immunity. With this latter view, Sitzenfrey,¹¹ Hollos,⁴⁹ Warthin,¹² and the author are in accord.^{12a} Many excellent observers, however, hold a contrary opinion. Pehu and Charlier⁵⁶ believe that the offspring of tuberculous parents are prone to defective development. They think that these children undoubtedly present a receptive soil for all diseases, but not especially to tuberculosis.

Undoubtedly, many cases have been recorded in which tubercle bacilli were positively demonstrated in large numbers in the fetus or new born child, no other pathologic changes being present—a finding that requires further study.

Tuberculous Bacillemia.—The frequency with which tubercle bacilli occur in the blood stream in infected individuals is a somewhat disputed point.

The Histology and Physiology of the Placenta in Relation to the Routes of Transmission of the Tubercle Bacilli.—For a thorough understanding of placental and congenital tuberculosis a knowledge of the pathological processes that occur in these conditions is necessary. An important point that immediately presents itself to the investigator is whether or not the transmission of the tubercle bacilli occurs through the

normal placenta. A number of cases are on record in which congenital tuberculosis has been observed in the child and no histologic changes were detected in the placenta. Even more numerous are the cases in which tubercle bacilli were demonstrated in the placenta, or fetus and placenta, and in which no histologic changes were found. In accepting these cases as genuine, care must be observed, as the demonstration of tubercle bacilli in the blood, either by staining methods or by animal inoculation, is not reliable unless a strict technic is adhered to. It must also be remembered that, in order positively to prove that the placenta in a given case was normal, the entire structure must be subjected to serial section. So far as can be ascertained, this stupendous task has never been attempted, and even if it were, the possibility that healing might have occurred in the placenta after the tubercle bacilli were transmitted could not be entirely excluded. Warthin and others have described the healing of tuberculous lesions in the placenta.

The placental transmission of syphilis, leprosy, variola, anthrax, pneumonia, and recurrent fevers has been positively demonstrated in man (Lubarsch,⁷² Schaudinn,⁷³ Paschen,⁷⁴ Wallich and Levaditi,⁷⁵ Menetrier and Ribeno-Duval,⁷⁶ Neuhaus,⁷⁷ Freund and Levy,⁷⁸ Van der Wittigen,⁷⁹ Dorland,⁸⁰ Runge,⁸¹ Nattan-Larrier and Brindeau,⁸² Delestre,⁸³ Bar and Renon,⁸⁴ and others).

Preyer,⁸⁵ Savory,⁸⁶ Fournier,⁸⁷ and others have demonstrated that toxins injected into the mother may produce the death of the fetus. As early as 1877, Zweifel⁸⁸ showed that chloroform administered to the mother also affected the fetus, and more recently the work of Jung⁸⁹ has shown the passage of certain drugs through the placenta.

Under normal circumstances the blood in the intervillous spaces is entirely maternal in origin (Waldeyer,⁹⁰ Bumm,⁹¹ Leopold,⁹² etc.), as the fetal blood at no time gains direct access to the intervillous spaces, the two blood supplies being separated from each other by the vessel wall and the two layers of chorionic epithelium. During the latter stages of pregnancy Langhans' layer is, however, absent. It seems probable that, when material is transmitted through the placenta, the process is effected partly by osmosis and partly by the direct action of the syncytial cells, the physiology of the latter being somewhat analogous to that of the renal tubules. Williams,⁹³ and Cornet³⁷ are of the opinion that when the placenta is normal and the epithelium covering the villi is intact, transmission of the disease germs cannot occur, but that when lesions of the placenta are present, transmission may take place. It remains to be decided, however, whether the lesions that have been demonstrated in some cases of tuberculosis have antedated the disease, or whether they

have been the result of tuberculous toxins produced by the bacteria in the intervillous blood. Delore⁹⁴ is of the opinion that the disorganization of the syncytium is not the result of toxins or of inflammation, but is due to a myxomatous degeneration. Warthin⁹⁵ believes that the syncytium of the chorionic villi is no more immune to the action of the tubercle bacilli than is the vascular endothelium in other parts of the body, and that the theory that tubercle bacilli can pass through this layer of cells without causing injury to it is founded on fact. Sitzenfrey¹¹ is of a similar opinion. In this connection it should be stated that the intervillous spaces are not lined by endothelium, except for a short distance on the surface of the decidua basalis, into which the endothelium of the maternal vessels extends. The author is of the opinion that tubercle bacilli may be transmitted through the normal placenta. This opinion is based upon the fact that a number of cases are on record in which undoubted congenital tuberculosis has been present and a careful examination of the placenta has failed to show histologic lesions in the same.

In the case of tuberculosis, at least, this question is perhaps of more theoretic than of practical value. It is probable that the toxins, the result of enmeshed tubercle bacilli, may produce injury to the syncytium, and thus by the damage incurred, prepare the way for the entrance of tubercle bacilli. Furthermore, in the latter months of pregnancy, infarcts are frequently present, and doubtless constitute foci by which ingress is secured for the organisms in the intervillous spaces.

Williams describes five varieties of infarcts. All placentas contain small infarcts, and Williams states that these attain a diameter of one centimeter or more in 63 per cent of cases. Owing to the histologic structure of the decidua basalis and placenta, these structures offer especial facilities for the enmeshing of microorganisms circulating in the maternal blood stream, a point that has recently been emphasized by Warnekros.⁹⁶

It is probable that, in the majority of cases in which congenital infection occurs, the tubercle bacilli travel through the decidual arteries to the covering of the villi and there accumulate, causing thrombi in their own and in adjacent intervillous spaces, with subsequent destruction of the syncytial cells, enter the villous stroma, and finally reach the chorion. To what extent this process is aided by the action of the toxins is not definitely known, but it would seem probable that they act as predisposing factors and tend to weaken or even destroy the intervening layers of cells.

Schmorl and Kockel,⁹⁷ in their carefully prepared report of the pathology of placental tuberculosis, state that placental villi, even when en-

tirely embedded in the tuberculous areas, tend to retain their integrity and are easily differentiated from the surrounding tissue. "Even the identical villus on which the primary localization of the tubercle bacilli occurred, and which, in consequence, lacks its cellular sheath in places, remains for a long time unchanged. The tubercle bacilli may be very plentiful in the tuberculous new growth, yet within the villi surrounding this area we find but few." These authors further declare that, even if the villus becomes tuberculous, a thrombosis and partial obstruction to the vessel occur, which may entirely or in part prevent the passage of the bacillus.

As has previously been stated, the infarcts that are so frequent in the latter months of pregnancy also probably serve in some instances as channels for the invading microorganisms. The virulence of the infecting agent and the resistant power of the host are also probably important factors in the production of the disease. It is a significant fact that a large proportion of the reported cases of congenital tuberculosis have occurred in conjunction with the acute miliary variety of the disease.

Undoubtedly the strong uterine contractions incident to labor constitute a most important factor in the transmission of tubercle bacilli at the end of pregnancy. Organisms that, prior to the onset of labor, were lodged in the placenta or in the intervillous spaces, may, as the result of these contractions, be forced into the fetal circulation. Schlimpert,¹ Schmorl and Geipel,³ Warthin and Cowie,¹² Dardeleben, and others are very insistent on this point. Tubercle bacilli are relatively frequently transmitted through macroscopically normal placentas, and may possibly pass through histologically normal organs, although positive proof of the latter is lacking.

In addition to the hematogenous infection, tubercle bacilli may reach the decidua by direct extension from the fallopian tubes or cervix, and thence, by continuity, pass into the placenta. A lymphatic infection from an adjacent tuberculous lesion may also occur. In either of these ways a focus of infection is set up in the decidua, and may extend to the chorion, thus reaching the body of the fetus, and infecting it through the respiratory tract, the result of inspiration of the amniotic fluid, through the gastro-intestinal tract, or through the skin. Asch⁹⁸ and numerous other observers have recorded instances of supposed intra-uterine sucking, and even in adults, whose dermis should be more resistant than that of the fetus, infection without macroscopic loss of continuity has occasionally been observed (by Leloir,⁹⁹ Baginsky,¹⁰⁰ and experimentally by Wasmuth,¹⁰¹ Roth,¹⁰² and others). In a case described by Schmorl and Geipel³ a tuberculous area in the chorion had penetrated the amnion,

and tubercle bacilli were found on the surface of the membrane. Herrgott¹⁰³ inoculated guinea pigs with the amniotic fluid of a tuberculous woman who died in the sixth month of pregnancy. The animals developed tuberculosis, showing that, in this case, the amniotic fluid contained virulent tubercle bacilli.

Aside from the infarcts previously mentioned and the fact that high fever is likely to produce a loss of continuity of the maternal and fetal blood vessels and thus favor transmission of the bacillus, disease of the placenta other than tuberculosis may produce lesions that will facilitate the occurrence of a congenital infection by opening up avenues for the entrance of tubercle bacilli. This is particularly the case in syphilis, of which Hochsinger's¹⁰⁴ case is an example. Trauma may also serve as a predisposing factor in the transmission of the bacillus through the placenta.

In examining specimens of suspected congenital tuberculosis, the greatest care must be observed to exclude cases of possible extra-uterine infection. As pointed out by Virchow, syphilis may closely simulate tuberculosis. Henle¹⁰⁵ described a case of pseudotuberculosis in new born twins.

It must be remembered that placental tuberculosis does not necessarily imply a transmission of the infecting organism to the fetus, although, of course, the condition strongly favors congenital tuberculosis, for, if advanced, it must produce lesions that facilitate the passage of the bacilli through the placenta.

Frequency of Congenital Tuberculosis.—Tuberculosis is the most frequent serious infectious disease that attacks mankind. It has been estimated that from 9 to 12 per cent of all deaths are due to tuberculosis. In Germany, during one year, the mortality statistics show that diphtheria, pertussis, scarlatina, rubeola, and typhoid fever were accountable for 116,705 deaths, whereas during a similar period tuberculosis was responsible for 123,904 deaths.

Genital tuberculosis is by no means an uncommon affection. Genital lesions are predisposing factors to congenital tuberculosis, especially if the fallopian tubes are patulous. The frequency of this form of infection is, therefore, of especial interest. In the gynecological laboratory of the University of Pennsylvania it has been found that seven per cent of all cases of pelvic inflammatory diseases are of tuberculous origin. Williams⁵ states that eight per cent of all cases of adnexitis are tuberculous. Merlitti¹⁰⁶ places the proportion at 12.6 per cent. The reports from the University laboratory and from Williams are based upon operative material, and are of especial value, as in both clinics all specimens

are subjected to a routine histologic examination. Martin²⁰ found twenty-four tuberculous cases among 1,600 gynecologic specimens. Barkley,¹⁰⁷ in 789 autopsies performed upon women dead of tuberculosis, found the genital tract involved in 7.7 per cent. In 174 cases of similar material from the Henry Phipps Institute, examined by the writer, 6.6 per cent showed macroscopic involvement of the genitalia.

In studying the frequency of congenital tuberculosis a number of points must be considered. The great prevalence of tuberculosis and the comparatively small number of authentic cases of congenital infection that are recorded are conclusive proof, it would seem, of the rarity of the variety of the disease in question. On the other hand, it should be remembered that tuberculosis of the placenta does not by any means always present macroscopic lesions. There is, moreover, probably no branch of pathology that has received less attention than the histologic study of the placenta. Baumgarten's theory, although doubtless extreme in some respects, has done much to show that congenital tuberculosis may occur, and that tubercle bacilli may remain latent in the child for quite prolonged periods. It has been shown that the tubercle bacillus may remain latent for some time. Under such circumstances congenital tuberculosis is probably mistaken for, and classified as, a postnatal infection. The transmission, through the human placenta, of microorganisms of other diseases is a point tending to show that congenital tuberculosis may be more frequent than is generally supposed.

Until comparatively recently it was the general belief that congenital tuberculosis rarely, if ever, occurred, and for this reason but few placentas were examined in order to determine its existence. As has been stated, even a negative histologic examination does not by any means exclude the presence of tubercle bacilli in the placenta, and it is only by routine histologic and bacteriologic examinations of a large series of placentas and other products of conception from tuberculous women that reliable conclusions can be reached regarding the frequency of placental and congenital tuberculosis. Owing, probably, to the difficulties of securing such material, a sufficiently large number of such examinations have not been made. Sitzenfrey's¹¹ series of 26 cases is the largest found in the literature. When such studies have been carefully carried out, the results have almost invariably shown that the presence of tubercle bacilli in the placenta is by no means infrequent. It is a significant fact that recent investigators have found both congenital and placental tuberculosis much more frequent than did those of the previous decade, the result, probably, of the more thorough methods of study now employed.

Bossi⁵⁵ failed to find tubercle bacilli in any of the placentas exam-

ined by him. Pankow,⁴ in a series of 20 placentas from tuberculous women, was unable to demonstrate tuberculosis in a single case. Despite this fact, however, this investigator believes that placental and congenital tuberculosis are not rare. Schmorl and Geipel,³ on the other hand, found eight cases (40 per cent) of tubercle bacilli in the placenta in a series of 20 tuberculous women. Schlimpert¹ found tubercle bacilli in the placenta in eight of eleven cases. Sitzenfrey, in a series of 26 cases, found the organism in seven, and recovered the infecting bacilli twice from the fetal blood.

Novak and Ranzel² examined the placentas from ten cases of advanced pulmonary tuberculosis. The placentas were minced, washed in sterile water, digested in soda solution and pancreatin, and then mixed with 40 per cent antiformin solution. The sediment was again washed in alcohol, stained, and examined for tubercle bacilli. A histologic examination of the placentas was also made, and inoculation of guinea pigs was likewise carried out in many cases. As a result, these authors found positive evidence of tuberculosis in seven of the ten specimens examined. They regard the negative findings of other observers, especially those of Bossi⁵⁵ and Ascoli,¹⁰⁸ as due to faulty technic; or that, probably, as in some cases, the specimens were obtained from early pregnancies, in which case the infection would most likely be limited to the decidua. A summary of the cases of Schmorl and Geipel, Novak and Ranzel, Schlimpert, and Sitzenfrey shows that of 67 cases examined 30 per cent presented positive evidence of tubercle bacilli in the placenta, of placental tuberculosis, or congenital tuberculosis.

Many of the earlier results secured regarding the demonstration of congenital or placental tuberculosis are open to criticism because of the methods employed. Von Leyden¹⁰⁹ inoculated animals with portions of the liver, spleen, and lungs of a child born of a tuberculous mother, with negative results. Jaquet¹¹⁰ was unable to find tubercle bacilli microscopically in several human fetuses of tuberculous mothers. Vignal¹¹¹ inoculated portions of the livers and spleens of eleven human fetuses of tuberculous mothers into guinea pigs, with negative results. Treisser¹¹² performed similar experiments with the livers and lungs of three still born infants of tuberculous mothers, with similar results.

Bernard, Debrer, and Baron,¹¹³ in a series of 36 cases of advanced tuberculosis, found the placenta involved in 12.5 per cent. Bar and Renon¹¹⁴ found tubercle bacilli in the blood from the umbilical cord in two of five cases in which the mothers were tuberculous. It should be stated, however, that one, at least, of Bar and Renon's cases was not above suspicion.

Armann¹¹⁵ regards tuberculosis in infants as not infrequently of congenital origin. As a general rule, in hematogenous infections tubercle bacilli attack the lymphatic glands nearest their point of entry. In congenital tuberculosis, therefore, the liver, being the inlet for the placental blood, the lymphatic glands in this region would exhibit the first changes, and this is frequently the case. That the liver possesses some bactericidal properties should, however, be taken into consideration. In those infants in whom the liver is the organ chiefly involved, this fact is at least suggestive of congenital tuberculosis. Leroux,¹¹⁶ in 214 autopsies performed upon tuberculous infants, found the liver affected in eighty-two. Lannelongue,¹¹⁷ in 1,005 cases of surgical tuberculosis occurring in young children and infants, observed three that he considered of congenital origin. Müller,¹¹⁸ in 150 autopsies performed on tuberculous children, found the liver involved in 33.3 per cent of cases. Haupt¹¹⁹ was able to demonstrate that, of 617 of his tuberculous patients, 143 had tuberculous mothers.

In 1834 Hardy¹²⁰ reported the history of a case of tuberculosis of the uterus and placenta occurring in a phthisical woman. The report is, however, somewhat vague, and in view of the general ill defined knowledge of the pathology of tuberculosis at that period, this case must be regarded with doubt. The cases of Charrin¹²¹ and Jacobi¹²² are, for similar reasons, also open to suspicion.

Until 1891 no undoubted case of congenital tuberculosis had been recorded. During that year two cases were reported—one by Sabouraud¹²³ and one by Schmorl and Birch-Hirschfeld.¹²⁴ The latter authors were the first positively to demonstrate the presence of tubercle bacilli in the human placenta.

Runge¹²⁵ regards his case as the first in which tubercle bacilli were positively identified in the decidua. As usual, no giant cells were found, but numerous tubercle bacilli were present, chiefly in the decidua basalis. Johne⁹ was perhaps the first to report the history of an undoubted case of congenital tuberculosis, his specimen consisting of an unborn calf. Macroscopically, the uterus and placenta were normal. Since the publication of Johne's case, many instances of congenital tuberculosis in animals have been recorded. As early as 1897 Klepp¹²⁶ reported that he found numerous calves affected with this form of the disease, and stated that 2.63 per cent of all young born of tuberculous cows were infected *in utero*. Cases of congenital tuberculosis in cattle have been reported by Malrox and Brouwier¹²⁷ (2 cases), Czoker,¹²⁸ Bank¹²⁹ (3 cases), McFayden,¹³⁰ Siegen¹³¹ (38 cases), Lungwitz¹³² (2 cases), Nocard,¹³³ Grancher,¹³⁴ Kohler,¹³⁵ Misselwitz,¹³⁶ Bayersdorfer,¹³⁷

Becker,¹³⁸ Ruser,¹³⁹ Bärland,¹⁴⁰ Galtier,¹⁴¹ Bucher,¹⁴² and Lohoff.¹⁴³ The recent carefully prepared report of Brooks¹⁴⁴ tends to show that the frequency of congenital tuberculosis in cattle has been exaggerated. Of 200 calves born of tuberculous parents, all of which were immediately after birth removed from the mother and guarded from postnatal infection, not one became tuberculous.

EFFORTS TO PRODUCE CONGENITAL TUBERCULOSIS

Animal Experiments.—Gartner,³⁶ in an extensive series of experiments upon white mice, succeeded in producing congenital tuberculosis in from five to ten per cent of cases. This was effected by making intraperitoneal, intravenous, or intratracheal inoculations. Of nineteen litters in which the mothers were subjected to intraperitoneal injection of 0.001 to 0.002 c.cm. of a pure culture of tubercle bacilli, in two cases the young became infected. In an attempt to simulate miliary tuberculosis (bacilemia) this investigator injected 0.5 to 2 c.cm. of a pure culture of tubercle bacilli into the vein of the ear of ten healthy rabbits. Of fifty-one fetuses of young born to these animals, five (10 per cent) were tuberculous. In no case were all the young of a litter infected. The method of determining whether or not infection was present in the young was extremely thorough; it consisted of grinding the young or fetuses to a pulp and inoculating this into the peritoneal cavities of guinea pigs. For the purpose of producing conditions analogous to pulmonary tuberculosis, Gartner injected a drop of a pure culture of tubercle bacilli into the trachea of each of sixty-four mice; eighteen litters, consisting of seventy-four young, resulted. These were inoculated into 39 guinea pigs, and tuberculous young were found in 80 per cent of the litters. Another similar series of experiments performed at a later date upon twenty-eight subjects showed only one infected young animal. Landouzy⁴¹ and Lödenih¹⁴⁵ performed a similar series of experiments, two of the eighty-six young animals which resulted showing congenital tuberculosis. Numerous other investigators have, however, failed to produce congenital tuberculosis. Sanchez-Toledo¹⁴⁶ performed intravenous infection on fifteen guinea pigs, and in none of the twenty-five fetuses from these animals was tuberculosis present. Similar results were secured by intrathoracic inoculation.

A summary of Sanchez-Toledo's results show that no tuberculosis was demonstrated in sixty-five fetuses from thirty-two tuberculous mothers. Cornet,³⁷ in an extensive series of experiments, was unable to produce

congenital tuberculosis. Of 233 fetuses or young examined, not one was tuberculous. Von Nocard¹⁴⁷ inoculated thirty-two fetuses of four tuberculous rabbits into thirty-two guinea pigs, with negative results. Wolff¹⁴⁸ performed a similar test, employing forty-two fetuses of rabbits and guinea pigs, with one positive result. Galtier¹⁴¹ was unable to demonstrate tuberculosis in nine young from tuberculous guinea pigs and in one calf from a tuberculous cow. Grancher¹³⁴ and Straus¹⁴⁹ obtained similar results from the inoculation of suspected organs of fetuses from nine tuberculous female guinea pigs; fourteen of the progeny were inoculated at birth, with negative results, and the remainder were examined at varying periods up to sixteen months of age. Tuberculosis could not be demonstrated. Vignal¹¹¹ performed similar experiments with eleven guinea pig fetuses from tuberculous mothers, with negative results. Carajnis,¹⁵⁰ by inoculating the spleen of a fetus from a tuberculous guinea pig, secured a positive result. From the findings just recorded, it can well be seen that congenital tuberculosis is difficult to produce experimentally.

In studying congenital tuberculosis, a sharp distinction must be made between placental infection and fetal involvement. It by no means follows that, because a placental infection exists, the child is necessarily contaminated.

Criticism and Possible Sources of Error.—Attention has elsewhere been directed to the small number of cases of congenital or of placental tuberculosis in man that have been reported, and possible reasons for this have been advanced. A review of the literature since 1891 shows that much work has been done on this subject, and that the opinion of most observers is strongly opposed to the view that holds the condition to be frequent. On the other hand, a careful study shows that in most of the investigations in which a moderately large number of specimens were examined and thorough methods of research employed, a definite proportion of positive cases was demonstrated.

The microscopic demonstration of tubercle bacilli alone in smear preparations is in some cases to be looked on with suspicion, as the differentiation of other acid fast bodies must be carefully considered—a point that should be emphasized, I believe with Fraenkel and others, that the microscopic demonstration in smear preparations of blood is likely to be misleading. Slight errors in technic, or the presence of acid fast bodies other than tubercle bacilli, are prone to produce very erroneous results. The findings of Novak and Ranzel,² which have previously been quoted, and whose experiments were evidently carefully carried out, may be placed partly in this category.

Sitzenfrey¹¹ has very properly sounded a note of warning against accepting even inoculation results, unless the technic has been carefully safeguarded. The frequency of tuberculosis among laboratory animals, and the possibility that incipient tuberculosis may have been present before the inoculation was made; the possibility of contamination during, prior, or subsequent to the inoculation, and the marked susceptibility of guinea pigs to this form of infection, are all sources of possible error. Feyerabend¹⁵¹ has even mentioned the possibility of spontaneous tuberculosis occurring in guinea pigs. Even the histologic examination is open to misinterpretation. The similarity of the picture produced by certain forms of syphilis and other conditions to that of tuberculosis has previously been pointed out.

Experimentally produced congenital tuberculosis in animals is likewise not beyond criticism. The relatively large amounts of culture material inoculated usually far exceed what could possibly be present in the pregnant woman. Thus Gartner,³⁶ whose results are perhaps more convincing than those of any other investigator, employed quantities of culture which, if increased proportionately to the weight of an average woman, would amount to 350 gm. introduced into the trachea, 35 to 140 gm. into the circulation, and about 0.5 to 1.5 liters into the peritoneal cavity. These results show, therefore, that while congenital tuberculosis may be produced experimentally in certain animals, it should not be compared to what takes place in the tuberculous pregnant woman.

Period at which Intra-uterine Transmission is Most Likely to Occur.—Placental tuberculosis is undoubtedly most frequent in the latter months of pregnancy. As gestation progresses the maternal focus in the lungs or elsewhere is especially prone to exacerbations, and, as a result, organisms are more likely to be present in the maternal blood stream. Furthermore, hyperpyrexia tends to produce a solution of continuity of the fetal and maternal blood vessels. Not only is a bacillemia prone to develop at this time, but a great quantity of blood is passed through the placenta. The larger amount of blood present in the placental sinuses and the relatively slow blood current at this period predispose to the enmeshing of tubercle bacilli circulating in the maternal blood stream. The placenta itself is probably more receptive to tuberculosis than during its earlier development. Langhans' layer of cells is absent. As the end of pregnancy approaches, the placenta assumes characteristics that have caused it to be termed a senile organ (Williams,⁵ Eden,¹⁵² Warthin, Cowie,¹² and others). Very early hematogenous infection is also unlikely to take place; indeed, during the first few weeks the chorionic villi are devoid of blood vessels and are nourished entirely by osmosis.

As has previously been stated, some authorities regard the placenta as a secure filter that prevents the organisms of a maternal bacteriemia from gaining access to the fetus. This view is correct to a certain extent. This theory is based upon the assumption that the syncytium of the placenta is everywhere intact. In the latter months of pregnancy the chorion undergoes progressive atrophy. Anemic infarcts are constantly present in the placenta, and at these points egress is offered for the maternal microorganisms. It is probable that the fibrinous exudate which forms in these areas is an important factor in safeguarding the fetus. The bactericidal properties of the blood are perhaps also sufficient to destroy or inhibit the growth of a certain proportion of the tubercle bacilli. Indeed, Warthin and Cowie believe that it is only under exceptional circumstances, or when the organisms are present in large numbers, that transmission is likely to occur.

When tubercle bacilli are present in the intervillous spaces, labor itself, with its incident strong and frequent uterine contractions, is especially prone to force the microorganisms into the fetal blood stream. That labor is a powerful agent in the production of congenital tuberculosis has been recognized by practically all observers; in fact, Bardeleben goes so far as to perform a cesarean section as a prophylactic operation before the onset of labor in certain cases.

PREDISPOSING FACTORS TO PLACENTAL OR CON- GENITAL TUBERCULOSIS

As most of these factors have been mentioned in the preceding pages, only a summary will here be given. Excluding the germinative type, the existence of which rests merely upon a theoretic basis, the requirements for a placental infection to take place are a tuberculous bacillemia or a tuberculous focus in the immediate neighborhood of the placental site. Under predisposing factors, therefore, must be placed all conditions that favor the presence of tubercle bacilli in the maternal blood stream, such as acute miliary tuberculosis, phthisis florida, ulcerative lesions that tend to rupture into blood vessels, acute exacerbations of the disease, and a high temperature, which in itself tends to destroy the continuity of the blood vessels. In this connection, however, it must be remarked that Warthin has recently described a case of placental tuberculosis in which the lung lesion was quiescent, and the attention of the attending physician was called to the tuberculosis only by the finding of miliary tubercles in the placenta.

Syphilis and other disease of the placenta, as well as trauma, probably not only predispose to the development of placental tuberculosis, but undoubtedly serve as predisposing factors in the production of congenital tuberculosis by forming avenues of egress for the circulating or enmeshed tubercle bacilli.

Tuberculosis of the peritoneum or of the female genital tract is also a predisposing factor to infection. The author has, however, seen two cases of advanced tuberculous peritonitis in pregnant women, and in neither was there gross evidence of infection in any of the products of conception. Unfortunately a thorough examination could not be made in either case. Williams has observed a somewhat similar case.

The Fate of the Congenitally Tuberculous.—Under this heading Cornet formulates an extremely unfavorable prognosis for children who are the victims of this variety of infection. Embryonic and fetal tissues possess no immunity to tuberculosis. It is probable that, if the fetus were infected during the early months of pregnancy, intra-uterine death or abortion would be likely to follow, whereas if the infection occurred late, it is probable that tuberculosis would manifest itself in the liver or adjacent lymphatic glands. It would appear, therefore, that the prognosis would be decidedly less favorable in the case of a congenitally infected child than in one who acquired the disease postnatally. Furthermore, the virulence of the strain of an infecting organism is of importance in this connection. The mothers of congenitally infected children are often the incumbents of an acute miliary tuberculosis, a form of disease in which the organisms are usually extremely virulent.

A few years ago the author reported the results obtained in the examinations of fourteen placentas from tuberculous women. Since these 107 additional specimens have been examined, making a series of 121 placentas. The subjects from which these placentas were obtained were all suffering from pulmonary tuberculosis. They consisted for the most part of ambulatory cases, which were coming to the Henry Phipps Institute for treatment. Almost 15 per cent were in a moderately acute stage of the disease at the time of delivery, and two were nearly moribund. The remainder were mild or quiescent. One hundred and one were at or nearly at term; the remainder were premature, some as early as the second month. In brief, the following technic was employed: five to ten small pieces were cut from various parts of the placenta and were finely ground up with sand in a mortar, to which was added a little salt solution. This was allowed to stand for a short time, and about a dram of the solution was injected into the peritoneal cavity of a guinea pig, five pigs being used for each placenta. All pigs

dying after the fifth day were autopsied, and at the end of six weeks all the remaining animals were killed and examined. A case was considered positive for tubercle bacilli where three of the five inoculated pigs showed tuberculosis. There were fourteen such cases. Inoculations from three additional placentas showed tuberculosis in one or two of the five pigs injected. Specimens in which all the inoculated animals died during the week subsequent to inoculation are not included in this series. Thus virulent tubercle bacilli were demonstrated with moderate certainty in 11 per cent of the specimens, and may have been present in an additional 2 per cent of the placentas.

CONGENITAL TUBERCULOSIS

(Case Histories)

Undoubted Cases.—In the following cases the diagnoses were based upon anatomical changes and the presence of tubercle bacilli.

Sabouraud.¹²³ Child aged eleven days, born of mother in advanced stage of pulmonary tuberculosis, who died shortly after delivery. Autopsy of infant showed the presence of countless miliary tubercles in the liver and spleen, in part showing caseation, and containing tubercle bacilli.

Lehmann.¹⁵³ Woman forty years of age, suffering from advanced pulmonary tuberculosis, gave birth to a premature, male child in the ninth month. The mother died two days after delivery. Autopsy showed acute miliary tuberculosis of lungs and tuberculous meningitis. The placenta was not examined. The child died twenty-four hours after birth. Autopsy showed miliary tuberculosis of the lungs, liver, spleen, and kidneys. Tubercles were also present in the portal, mediastinal, bronchial, mesenteric, and retroperitoneal glands. The microscopic appearance was that of typical tubercles. Large numbers of tubercle bacilli were found. No giant cells were present in the tubercles. Advanced stage of the process makes the case undoubtedly congenital.

Honl.¹⁵⁴ Child, fifteen days old. Autopsy revealed typical caseous miliary nodules in the spleen, liver, lungs, containing numerous tubercle bacilli. These were also found free in the blood vessels. Chronic tuberculous lesions were found in the liver. Mother was brought to the hospital with pulmonary tuberculosis after birth of child. The case is regarded as undoubtedly congenital, as such advanced lesions could not have formed during the short period of extra-uterine life.

Ustinow.¹⁵⁵ New born female child weighing 3,060 gms. Died of

inanimation after a few days. Nothing known of the mother. Autopsy of infant showed general tuberculosis, most marked in the liver. The spleen was somewhat enlarged, and contained so many tubercles that the surface presented a marbled appearance. Lungs contained a smaller number of tubercles. The brain and retina of both eyes were free from tubercles. Large numbers of tubercle bacilli were found in the tubercles and also free in the capillaries. In some sections the bacilli were so numerous that when stained for tubercle bacilli the red areas were visible to the naked eye.

Auche and Chambrelente.¹⁵⁶ Mother, in advanced stage of tuberculosis, died three days after a premature delivery in the seventh month. Autopsy showed advanced tuberculosis of the lungs, liver, spleen, intestines, mesenteric glands, and kidneys. The uterus and adnexa were normal. Peritonitis was not present. The placenta showed numerous caseous tubercles with tubercle bacilli. Inoculation of guinea pigs with portions of placenta gave positive results. Child died on the twenty-sixth day. Autopsy showed miliary tubercles in the lungs, liver, spleen, and endocardium of the right heart. Typical tubercle bacilli were present. Inoculation of rabbit with portions of fetal organs gave positive results. The tuberculous endocarditis is of especial interest, as the first case noted in infants. The woman had three other healthy children.

Veszpremi¹⁵⁷ reports a case of congenital tuberculosis. Tubercle bacilli were demonstrated from the fetal blood by means of inoculation. The mother was the victim of advanced miliary tuberculosis. Owing to unfortunate circumstances, it was not possible to examine the placenta.

Dufour and Thiers¹⁵⁸ report a case of tuberculosis of a fetus. Mother, aged nineteen years, having symptoms of advanced pulmonary and meningeal tuberculosis. The latter was proved by puncture and demonstration of the microörganism. She died twelve days after admission to the hospital. Autopsy showed extensive tuberculosis. The fetus was partially expelled into the vagina. The abdomen was enlarged and ascitic. The placenta was macerated and suggestive of tuberculosis in its appearance. Ascitic fluid from the chest of the fetus, by inoculation, was found to contain tubercle bacilli. The placenta showed histologic evidence of tuberculosis, but tubercle bacilli were not demonstrated in it.

Brindeau.¹⁵⁹ The child of a tuberculous mother, died on the twelfth day. Autopsy showed very advanced pulmonary lesions, and from these tubercle bacilli were demonstrated. The advanced character of the lesion present makes it extremely probable that this case was one of true congenital infection.

Stöckel.¹⁶⁰ The mother had advanced tuberculosis. No tuberculosis

was found in the placenta. The child lived fourteen days. At autopsy the cadaver showed extensive miliary tuberculosis, especially of the lungs, liver, and intestines, and marked caseations, especially of the periportal glands.

Zarfl.¹⁶¹ The infant was born of a tuberculous mother. On the seventeenth day the von Pirquet reaction was markedly positive. The author believes such sensitiveness to tuberculosis could not have developed in seventeen days. On the eighteenth day there was enlargement of the liver and spleen. The swelling of the spleen increased and was the most prominent symptom. Until the last week there was no clinical or Röntgen ray evidence of tuberculosis. This child died on the fifty-second day. Autopsy showed involvement of lymph nodes of the liver region, the most seriously involved. Slight involvement of bronchial lymph nodes and no focus in the lungs. The mother lived for three months after the birth of the child.

Jens Bugge.¹⁶² The patient, aged thirty-nine years, died of tuberculosis four days after delivery. Autopsy showed tuberculosis of the lungs, bronchial glands, kidneys, and intestinal tract. The placenta was not examined. The infant was eight months advanced and died thirty hours after delivery. No tuberculosis was found macroscopically, but tubercle bacilli in the umbilical vein were demonstrated by staining and inoculation.

Möller¹⁶³ reports a case of tuberculosis in a child which died on the third day. The mother left the hospital well, but returned five months afterward with tuberculosis of the uterus, and died of miliary tuberculosis in two months. Autopsy of the child showed miliary tuberculosis of the liver and spleen, a tubercle in the pancreas, two typical ulcers in the ileum, miliary tuberculosis of the lungs, massive tuberculosis of the retroperitoneal lymph glands, and a caseous mass in the thymus. Tubercle bacilli were found in the lesions. Recent tuberculosis lesions were found in the decidual membrane and panhysterectomy was performed. Old tuberculosis processes were evident in both fallopian tubes, and to these Möller attributes the infection of the uterus and the fetus. When the woman was delivered there was no suspicion of tuberculosis and the placenta was not examined.

Grulee and Harms¹⁶⁴ reported a case of miliary tuberculosis in a child which died on the eleventh day. This child showed throughout an irregular temperature. On the fifth day it had a convulsion which continued until death. The liver and spleen were found to be enlarged. At autopsy there were found caseous tubercles of the periportal and mesenteric lymph glands, miliary tuberculosis of the spleen with caseous

nodules, and a few scattered nodules in the liver, lungs, and kidneys. The mother of this child had what was apparently only a healed tuberculosis of the hip. She had, however, a vaginal discharge of unknown etiology. The mother was alive several months after the infant was born.

Probable and Doubtful Cases.—In these cases the diagnoses were based upon anatomical appearance only, gross or microscopic, without demonstration of the presence of tubercle bacilli; or doubtful because of age of child, non-elimination of possible syphilis, extra-uterine infection, etc.

Delmas.¹⁶⁵ The mother was moribund from advanced phthisis at the time of her confinement. The child was delivered by forceps and immediately placed in a sterilized incubator. No further communication between the mother and child occurred. The child died when four months old, the lungs being chiefly affected. Delmas believes the infection to have been a hematogenous one. There were no intestinal lesions.

Bourges.¹⁶⁶ The mother died of tuberculosis shortly after having been delivered of a viable child. At autopsy she showed advanced lesions. The child survived but a short time. An autopsy on it showed no macroscopic evidence of tuberculosis, but inoculations from the liver and other areas into guinea pigs gave a positive result. In another case, negative results were obtained.

Jacobi.¹²² Seven months' fetus of a mother suffering from chronic pulmonary tuberculosis had numerous caseating tubercles in liver, spleen, pleura, and peritoneum. Anatomical evidence only.

Demme.¹⁶⁷ Two cases: 1. Boy of five weeks. Sick from birth with fever and cough; showed on autopsy caseous nodules in both lungs and infiltration of bronchial and tracheal glands. Mother died of chronic pulmonary tuberculosis soon after delivery. 2. Child died on seventeenth day after delivery. Similar to the first case. Tuberculosis in mother shown by physical signs. Both cases are doubtful.

Charrin.¹²¹ Seven and a half months child of a tuberculous mother, died three days after birth. Autopsy showed widespread tuberculosis of the peritoneum and abdominal organs. Scattered tubercles were found in the lungs. Anatomical evidence only.

Demme.¹⁶⁷ Female child, twelve days old, of tuberculous mother. Autopsy showed caseous bronchial glands and numerous caseating nodules in both lungs. In the right apex and right lower lobe many cavities, the size of a pea to a cherry, are found. Mesenteric glands are unchanged. Doubtful case. Anatomical evidence only.

Merkel.¹⁶⁸ (Not reported until 1884 by Ohlendorff). In January, 1875, patient developed pleuritis, followed by bronchial catarrh and infiltration of apices. In February she conceived; in June showed tuberculous laryngitis; by October the patient had to be fed with tube; and the child was born on November 4. On the 6th the mother died. Autopsy showed tuberculous cavities in the lungs and miliary tuberculosis. The child was small and was born with a small yellow tumor on hard palate. On the second day this discharged cheesy material; abscess then developed in left greater trochanter. Child died of inanition. Autopsy showed caseous nodule in hard palate infiltrating the bone, caseation of cervical glands, caseous nodule behind the left hip joint. Probable case. Anatomical evidence only.

Demme.¹⁶⁷ Female child, aged twenty-five days. Mother died of catarrhal pneumonia. Autopsy of child showed in the middle of the right cerebellar hemisphere a caseating tubercle the size of a hazel nut. The microscopic examination showed the appearance of caseating tubercles. No tuberculosis elsewhere. Doubtful case.

Baumgarten.¹⁶⁹ States that in autopsies on infants dying during the first months of life he had often found tuberculosis of such advanced stage as to make a congenital origin very probable.

Berti (cited by Gartner).¹⁷⁰ Tuberculous mother, aged seventeen years. Child died on the ninth day after birth. Autopsy showed two small cavities, filled with caseous material, in the posterior margin of lower right lobe of the lung. Microscopic examination confirmed the gross diagnosis of tuberculosis. Very probable case. Anatomical evidence. (Berti reports a second very doubtful case, which may be entirely ruled out.)

Demme.¹⁷¹ Two cases: 1. Child dying on twenty-first day. Autopsy showed advanced tuberculous ulceration of intestines. 2. Child dying on twenty-ninth day of pulmonary tuberculosis. Both cases very doubtful. History meager. Evidence, anatomical only. Extra-uterine infection not excluded.

Money.¹⁷² Female child of tuberculous mother, dying five weeks after delivery. Child ill for three weeks with cough and attacks of vomiting. No evidence of syphilis. Died in eighth week. Autopsy showed caseous tubercles of lung, liver, spleen, and kidneys. Bronchial and mesenteric glands enlarged, but no caseation. Intestines not ulcerated. One tracheal gland caseated. A probable case.

Demme.¹⁶⁷ Female child, aged eleven weeks, of tuberculous mother. Autopsy showed extensive cavity formation in the right lobe of the child's lung. A doubtful case. Extra-uterine infection not excluded.

Queyrat.¹⁷³ Three months old child; died and autopsy revealed extensive caseation and cavity formation in both lungs. Mother healthy; father tuberculous. Very doubtful. Extra-uterine infection not excluded.

Flesch.¹⁷⁴ Advanced ulcerative lesions were found in the lungs of eight out of five hundred infants upon whom autopsies were performed. All the subjects had died in the early months of life. Extra-uterine infection not excluded. Statement too inexact. Evidence, anatomical only.

Fröbelius.¹⁷⁵ Found in 16,581 autopsies of children under two years of age, 616 cases of tuberculosis. One died on the third day, one in the second week, one in the third week, three at about three and one-half weeks, fourteen in the second month, and one hundred and nineteen in the third month. No detailed account of these cases is given.

Houtinel.¹⁷⁶ In 996 autopsies upon infants under one year of age, eighteen cases of tuberculosis were observed, two dying in the first fourteen days after birth. No detailed account is given.

Lannelongue.¹⁷⁷ Out of 1,005 cases of surgical tuberculosis in children under fifteen years of age, four were observed which he regards as of undoubted congenital origin; one child, six weeks old, with classical signs of tuberculosis of knee existing from birth; one, one month old, tuberculous osteoarthritis fourteen days after birth; one, three weeks old, tuberculous abscesses in the left tarsus and right maleolar regions; one, sixteen days old, tuberculous osteitis. In these cases, Lannelongue believes it possible to exclude extra-uterine infection. In another child of two months, right sided tuberculous epididymitis with fistula was present. A scrotal engorgement some days after birth was noticed. Few details are given concerning the parents. All these cases are doubtful.

Huguenin.¹⁷⁸ Two cases, one dying at the age of seven weeks of general tuberculosis; the second at the age of seven months of a general tuberculosis. Very doubtful cases. Evidence, anatomical only. No details are given.

Bosselut.¹⁷⁹ In a large number of autopsies on children dying of tuberculosis, meningitis was found in one subject who had died on the fourteenth day; in two, aged three weeks; in one, aged six weeks; and in four, aged eight weeks. Evidence not conclusive. No details. Doubtful cases.

Rindfleisch.¹⁸⁰ Mother in advanced phthisis florida, developing during pregnancy, and died of phthisis shortly after birth of child. The child died on the eighth day of general tuberculosis. Large caseous nodules in the liver. Probable case. Anatomical evidence only.

Sarwey.¹⁸¹ Monster (cranioschisis); prolonged pregnancy. Born in eleventh month. The mother was apparently healthy. Father had cough and tubercle bacilli in the sputum. Child showed caseous and partly calcified nodules in the upper cervical vertebrae. Guinea pigs were inoculated. Three out of six developed tuberculosis after three months. A probable case.

Baumgarten.¹⁶⁹ Still born monster (encephalocele). Caseating abscesses in three uppermost cervical vertebrae. No bacilli found. Evidence only anatomical. Details not given. A doubtful case.

Leroux.¹¹⁶ The infant died when eighteen days old. Deep tuberculosis ulcers were found in the intestine. Caseation of tracheal and bronchial glands was present. Probably a case of congenital infection, as the extensive changes could hardly have occurred from extra-uterine infection.

Leroux also gives notes of twenty-two other cases of tuberculosis in children under three months; one, four weeks old; one, five weeks (premature birth); two, six months; five, two months; eight, two and one half months; five, two and three quarter months. No details given. All these cases are doubtful and based upon clinical observations only.

Wassermann.¹⁸² Child when first taken ill was six weeks old, and at that time had bronchial catarrh and osteitis (tuberculous?). Died four and one half weeks later. Autopsy showed extensive tuberculosis of both lungs, diaphragm, liver, and kidneys. Wassermann believed the case to be acquired from a relative of the mother, with whom the latter and child had resided for a short time when the child was ten days old. Correctness of this opinion questioned by Baumgarten and Lebküchner. Very doubtful case.

Hochsinger¹⁰⁴ reports three cases, aged thirty-one days, thirty-eight days, and sixteen weeks, respectively, of combined tuberculosis and syphilis. The mother in the first and third cases was tuberculous. Autopsies of children showed advanced tuberculosis in all three cases. Tubercle bacilli present in all. Age of children and the fact that congenital syphilis predisposes to rapid development of tuberculosis make these cases doubtful.

Straus.¹⁸³ Child died when three weeks old. Autopsy showed caseous tubercles in lung, spleen, bronchial, and mesenteric glands. Doubtful case. Full details not given.

Kissel.¹⁸⁴ In one thousand autopsies upon children, Kissel observed three cases of tuberculosis which he believed to be of congenital origin. These children were aged four, five, and six weeks, respectively. Small

advanced lesions of the bronchial glands were present. The cases are not reported in detail and must be considered as doubtful.

Holt¹⁸⁵ mentions one case, of a child dying on the twentieth day after a premature birth. The mother, suffering from advanced tuberculosis, died shortly after the child. On autopsy, the child was found to have caseous bronchial glands, and miliary tuberculosis of the lungs, none in liver, alimentary tract, or spleen. Regarded as probably congenital from advanced nature of lesions.

Henoch.¹⁸⁶ Father died of tuberculosis. The child had been ill since the sixth week from multiple tuberculous abscesses in various parts of the body. It died in the fourth month, of inanition. Autopsy showed advanced pulmonary tuberculosis, intestinal tuberculosis, and caseation of lymph glands. A very doubtful case. Extra-uterine infection probable.

Bonnet.¹⁸⁷ Mother died of pulmonary tuberculosis two months after delivery. Male child, ill from birth, died at three months. Autopsy showed both lungs studded with caseous tubercles, tuberculous ulcers in ileum, caseous tuberculosis in mesenteric glands, kidneys, spleen and liver. Fatty liver. The stage of lesions and the fact of illness from birth, the child having been kept from danger of infection, given as reasons for regarding the case as of congenital origin.

Johnson.¹⁸⁸ White female child born of mother suffering from tuberculosis of urinary tract. At birth the infant was very weak, small, and could not nurse. The emaciation increased. The child made efforts at coughing and died during a profuse pulmonary hemorrhage at the age of three months and two days. The father was healthy. Urine of mother contained blood, pus, and tubercle bacilli. Placental tuberculosis was probably present, the organ showing the usual histologic evidence of this infection. Autopsy of child showed extensive tuberculosis of the right lung pleura, and pericardium; miliary tuberculosis of the left lung. Tubercle bacilli could not be found in fetal organs. Evidence not complete, but most probably a case of congenital tuberculosis.

Lebküchner.¹⁸⁹ Two cases: 1. The mother was of a tuberculous family; suspicious symptoms, but case not certain. The child was short of breath and coughed from birth. It eventually died, and a postmortem showed advanced tuberculosis in lungs and other organs. 2. Case similar, but child older. The first case may be regarded as probable, though the evidence is incomplete.

Friedmann.¹⁹⁰ The mother had advanced tuberculosis. The child died when twenty-six days old; a postmortem showed a small tuberculous lesion in the apex of the right lung. Evidence not conclusive.

Lyle.¹⁹¹ Negress, twenty-two years of age, in seventh month of pregnancy, suffering from chronic pulmonary tuberculosis. The mother died two days after premature delivery. Autopsy showed chronic tuberculosis of both lungs and intestinal ulceration. The placenta appeared normal. The child weighed about three pounds. It was ill from birth; subnormal temperature for four weeks, followed by fever; died in eighteenth week. Autopsy revealed extensive tuberculosis of lungs, liver, spleen, and kidneys; tubercle bacilli were present in the caseous areas. The great number of tubercles of same advanced stage, the fact that the child was ill from birth and had been kept under such conditions as to exclude likelihood of extra-uterine infection, are the reasons advanced by Lyle for considering this case as congenital. It is doubtful, however, because of the age of the child.

Sitzenfrey.¹¹ 1. Patient aged thirty-eight years and octipara. Three children are living. She was delivered, by forceps, of a female infant, which weighed 2,620 grams. The patient died five days post partum. Autopsy showed pulmonary tuberculosis, tuberculous ulcers of the intestines, chronic tuberculosis of the peribronchial, mesenteric, and retroperitoneal lymph glands, subacute miliary tuberculosis of the liver, spleen, and kidneys, also meningitis basilaris tuberculosa. Tuberculous caries in the tenth and eleventh ribs (left) with fistula; also caries in the second to sixth dorsal vertebrae with prevertebral abscess. The infant was transferred at once to an institution and died six weeks after birth. Autopsy showed chronic pulmonary tuberculosis, chronic tuberculosis of the liver, spleen, thyroid, intestines, peribronchial, mesenteric, retroperitoneal and portal lymph glands. Case 2. Patient aged twenty-four years and quadripara. Two children died of gastro-intestinal trouble; one child is living and well. She had a spontaneous delivery of an eight months male infant, which weighed 1,800 grams, and which died two days after birth. The mother died the following day. Autopsy showed chronic pulmonary tuberculosis, chronic tuberculosis of the peribronchial, cervical, and axillary lymph glands, tuberculous ulcer of the larynx, tuberculous nodules in the skin of various portions of the body, chronic tuberculosis of the intestines, liver, peritoneum, and kidneys, and tuberculous meningitis. The inner surface of the lower uterine segment was yellow and caseous, but showed microscopically merely necrosis—no tuberculosis. The child died on the second day. Autopsy showed partial atelectasis of lungs, icterus neonatorum and debilitas vitae congenita. The placenta measured eleven by twelve centimeters. It was macroscopically normal, but the membranes show at two places, corresponding to the decidua vera, a certain amount of thickening three to four milli-

meters. The maternal surface of these is uneven, ragged, and grayish yellow. On section through these areas, the tissue shows a caseous condition. On the fetal side, these areas are covered by smooth amnion. Microscopic examination of the placenta and umbilical cord is negative for tuberculosis. Microscopic examination of the thickened portion of the membranes, however, shows extensive caseous foci, often associated with thrombosis in the decidua vera. In these areas giant cells are not found, but enormous quantities of tubercle bacilli are seen.

Sitzenfrey believes the entrance of tubercle bacilli into the fetal circulation in these cases may be explained perhaps by the aberrant nutrient vessels of the chorion, which arise from the umbilical cord and which might be invaded by tuberculous foci in the decidua vera.

Two cases have been reported by Schrumpf. Case 1. Patient, aged thirty years, died in seventh month of pregnancy, from chronic pulmonary tuberculosis. The decidua vera in the right and posterior uterine walls was found transformed into a caseous sheet, three and a half by five centimeters and four millimeters thick. Microscopically this tissue is full of round cell infiltration with tubercle bacilli and necrosis. There was no extension to the placenta or decidua basalis. Examination of the fetal organs showed these to be histologically normal, but a few tubercle bacilli were found in smear preparations from the fetal heart, blood and liver. Case 2. Patient, aged twenty-three years, died in the seventh month of pregnancy from chronic pulmonary, laryngeal and intestinal tuberculosis. The uterine mucosa showed an opaque, bright yellow area, one centimeter in thickness on the posterior wall and extending downwards from the outer edge of the placenta for about seven centimeters. Microscopically this proved to be an infiltration of the decidua vera with necrosis in places and a few tubercle bacilli. No miliary tubercles or giant cells. The placenta and decidua basilaris were normal. Examination of the fetus and animal inoculation were negative.

Sitzenfrey also reports two other cases which he believes to have been congenital and which have been excluded on account of the age at which the children died, three months and six months, respectively.

PLACENTAL TUBERCULOSIS

(Case Histories)

Undoubted Cases.—Diagnoses rest upon demonstration of histological changes and the presence of tubercle bacilli in the placenta.

Runge⁸¹ reports a case of placental tuberculosis occurring in a patient

suffering from active pulmonary lesions. The tubercle bacilli were demonstrated in the placenta, and the characteristic histologic changes produced by this organism were present.

Lehmann.¹⁹² Case 1. Woman, aged twenty-six years, died of miliary tuberculosis in seventh or eighth month of pregnancy. Male child removed by cesarean section five minutes after death of mother, showed no signs of life. Well developed. The only abnormal changes found were two grayish nodules in the right apex. Pieces of liver and spleen were inoculated into guinea pigs. The general appearance of the placenta was normal. In several places small miliary nodules grayish, semi-translucent, and sharply outlined, were found. The microscopical examination of fetal liver and lungs gave no appearance of tuberculosis. No tubercle bacilli were found. The placental nodules presented the appearance of typical caseating tubercles, containing a few tubercle bacilli. Case 2. The woman, aged thirty-two years, died in the hospital. No history of the case was obtainable. The autopsy showed tuberculosis of the lungs, endocardium, liver, both kidneys, meninges and the pulmonary veins. The uterus measured fourteen by nine by eight centimeters. On its anterior and posterior surfaces were small, grayish protuberances. The uterine wall was one and a half to two centimeters thick and very vascular. The cavity contained an ovum of about four months' development. A loop of the cord had prolapsed into the vagina. The placenta measured one to one and a half centimeters in thickness and was anterior in attachment. There were small hemorrhages in the placenta and a larger one between it and the uterine wall, showing that abortion must have begun before death. The adnexa were normal. Tuberculous granulation tissue was found surrounding the chorionic villi, and in a few tubercle bacilli were demonstrated.

Harbitz.¹⁹³ The mother was twenty-six years of age and entered the hospital with advanced pulmonary tuberculosis, of which she died twenty-eight days after confinement. Autopsy showed an acute miliary tuberculosis, involving the lungs, kidneys, peritoneal cavity, and fallopian tubes. The uterus, especially in the vicinity of the decidua basilaris, showed well marked tuberculosis. The infant measured forty-nine centimeters in length and weighed 1,930 grams. It died on the twenty-fifth day, having been previously isolated from the mother. Autopsy upon it showed extensive involvement of the lungs and bronchial lymph glands.

Warthin.¹⁹⁴ Patient, aged twenty years, with a previous history of gonorrhea. Tuberculosis was not suspected, but during the routine course of the histologic examination of the placenta, as practiced in Dr. Peterson's clinic, numerous miliary tubercles, many of them healing,

were found. In some of these areas, tubercle bacilli were demonstrated by staining. Examination of the mother showed a positive tuberculin test, a suspicious right apex, but no evidence of active disease. The child was viable, and no tuberculosis demonstrated in it.

Carl.¹⁹⁵ The mother showed advanced pulmonary tuberculosis and the usual clinical symptoms. The child was normal, but in the placenta typical tubercle bacilli were demonstrated, together with the histologic evidence of this infection.

Lehmann.¹⁵³ Mother died of chronic tuberculosis of lungs and larynx. The child died ten days after birth. It presented no evidence of tuberculosis at autopsy. Typical caseating tubercles containing tubercle bacilli found in the placenta.

Schmorl and Kockel.¹⁹⁷ Case 1. Woman, aged twenty-six years, in seventh or eighth month of pregnancy, died of chronic tuberculosis and miliary tuberculosis. Child, removed by cesarean section, lived two hours. No histological changes of tuberculosis or tubercle bacilli found in fetus. Placenta appeared normal to the naked eye. Numerous tubercle bacilli found in smears from the placenta. Animal inoculation was negative. On microscopic examination, placenta showed typical tubercles in all stages. Tubercle bacilli in large numbers were demonstrated. Case 2. Mother, aged twenty-five, died of general miliary tuberculosis. Fetus removed at autopsy. No evidence of tuberculosis in fetal organs. Typical tubercles containing bacilli found in the placenta. Case 3. Woman, aged thirty-three, died in ninth month of pregnancy of chronic pulmonary tuberculosis. The child was removed by cesarean section; dead when uterus was opened. Male child, showed nothing suggestive of tuberculosis. No tubercle bacilli found in fetal tissues. Placenta presented no naked eye appearances of tuberculosis. Animal inoculations with fetal tissue were negative. Microscopically, the placenta showed typical tubercles in varying stages, not so numerous as in cases 1 and 2. Tubercle bacilli were present in large numbers.

Jung.¹⁹⁷ Woman showed advanced pulmonary tuberculosis. The placenta presented the usual histologic picture of tuberculosis. Tubercle bacilli were also demonstrated. Tuberculosis was not present in the child.

Warthin.¹⁹⁸ Case of tubal gestation with tuberculosis of tubes, placenta, and fetus. Rupture of the tubal sac in fourth month; operation. Advanced tuberculosis of tubes, and wall of sac. Chorionic villi involved directly by extension from wall of tube. Typical tubercles in chorionic villi. Few tubercle bacilli found.

In one of fifty successive placentas examined at the Stadt Kranken-

haus in Dresden (Schmorl's laboratory) miliary tubercles in all stages of development were found by Warthin. The placenta was full term. A few bacilli were demonstrated in it. Nothing was known of mother or child, as placenta could not be identified.

Auche and Chambrelente.¹⁹⁹ Mother, far advanced in tuberculosis, died three days after premature delivery in seventh month. Placenta showed numerous caseous tubercles containing tubercle bacilli. Inoculation of guinea pig, positive. Child lived twenty-six days. Autopsy showed extensive tuberculosis.

Wollstein.²⁰⁰ Mother died of tuberculosis six days after birth of an eighth month child. Placenta measured seventeen centimeters in diameter and three millimeters in thickness. It contained grayish, yellowish, or cheesy nodules. Histologically, agglutination, thrombi, and destruction of the syncytium and other evidences of tuberculosis were present. The umbilical cord was normal. The uterine mucosa was the seat of a tuberculous deciduitis. Tubercle bacilli were demonstrated. The infant lived nineteen days. No tuberculosis demonstrated in it. This case was one of hematogenous infection.

Walther.²⁰¹ A patient with a definite family history of tuberculosis died in the seventh month of pregnancy. Macroscopically, the placenta showed yellowish white patches which microscopically proved to be areas of tuberculous caseation involving the decidual portion of the organ. These lesions affected the maternal aspect of the placenta only. Neither the fetus nor the umbilical cord showed any evidence of the disease.

Sitzenfrey¹¹ reports the following cases: Case 1. Patient, aged twenty-eight years and primipara, had a spontaneous delivery of a male infant which measured forty-one centimeters in length and which died after four hours. The mother, who had a history of slight lung trouble and hemophesia, rapidly developed symptoms of acute miliary tuberculosis and died three days later. Autopsy showed chronic tuberculosis of both upper lobes, chronic tuberculosis of the peribronchial lymph glands, tuberculous ulcer of the larynx, universal miliary tuberculosis, and chronic catarrh of the large and small intestines. Autopsy of infant showed total fetal atelectasis of lungs and multiple ecchymoses of pleura and pericardium. No tuberculosis found in the infant.

The placenta measured fourteen centimeters in diameter and two centimeters and a half in thickness. It weighed 3,300 grams, and showed no gross abnormalities in the fresh state. After hardening, the outer surface showed numerous gray red to yellow or whitish, opaque nodules, which presented the appearance of the little infarcts often found in normal placentas. In practically all sections made for microscopic examina-

tion, there were found numerous foci of caseation and round cell infiltration, in the decidua basalis, in the villi, on the edge of the infarcts, and in the chorionic membrane. In these areas numerous tubercle bacilli, also small nodules containing tubercle bacilli, were found in the lumen of veins in the decidua basalis. These foci of round cell infiltration are not characteristic of tuberculosis alone, but may be found in various other conditions; their definite diagnosis as tuberculous is dependent upon the demonstration of tubercle bacilli. In some areas these inflammatory foci with tubercle bacilli could be seen to have broken into the intervillous spaces. Numerous tubercles of various types are present in the villi. The tubercle bacilli apparently work their way into the syncytial covering of the villi and injure it; the syncytium becomes swollen, loses part of its staining properties, and contains vacuoles, in which the tubercle bacilli are found. As a result of this process, the syncytium loses its power of preventing blood coagulation, causing thrombotic deposits to be formed on the surface of the villus, containing numerous leukocytes. Under the influence of the tubercle bacillus these masses caseate; new areas of coagulation are formed which involve surrounding villi, and in turn succumb to tuberculous destruction, often earlier than the villus which formed the first nidus for the bacilli.

No tuberculosis was found in the umbilical cord in this case. One tubercle bacillus was found in the lumen of a vessel in a villus, hence the author believes it probable that bacilli had reached the fetus, although microscopic examination of various organs was entirely negative. He thinks the toxic effect of the metabolic products of the tubercle bacilli was the underlying cause of the death of the fetus four hours post partum.

Case 2. Patient, aged thirty-four years, had induction of labor on account of pulmonary and laryngeal tuberculosis. The male infant weighed 2,150 grams. The child was immediately removed from the mother and placed in an orphanage. Blood from the umbilical cord collected and injected into a guinea pig, which remained healthy and on being killed, showed no signs of tuberculosis. The placenta measured sixteen centimeters in diameter, weighed 480 grams, and macroscopically showed no pathologic changes. The mother did well for a time, but died about four months post partum with symptoms of peritonitis. Autopsy showed chronic pulmonary tuberculosis, chronic tuberculosis of the trachea, larynx, and of cervical and peribronchial lymph nodes, chronic tuberculosis of the intestines with perforated ulcer in the ileum: one half a liter of fecal fluid was found in the peritoneal cavity. Tubercles were found in the liver, kidney, uterus, and tubes. The endometrium

showed caseous areas and tubercles. The walls of the tubes were thickened in places and reduced to caseous masses.

The child died at the end of three months. Autopsy showed chronic tuberculosis of both lungs with pleuritis, chronic tuberculosis of the peribronchial lymph glands, extensive tuberculous ulceration of the large and small intestines, tuberculosis of the mesenteric glands, miliary tuberculosis of the liver, spleen, kidneys; a few whitish nodules in the fossa of Sylvius, suggestive of tubercles.

The placenta was cut into slices and thirty blocks studied histologically. In only three of these were tuberculous changes found. Although very few foci were present, some of these were fairly large, involving decidua basalis and villi. No bacilli were found in vessels. Sitzenfrey believes, however, that probably the bacilli got into the fetal circulation. In many cases the peripheral capillaries of the villi were engorged to bursting point, and in some places have actually burst, permitting maternal and fetal blood to mix. This congestion may have been due to pressure on the umbilical cord by the bag which was introduced to induce labor. Microscopic examination of the umbilical cord for tubercle bacilli was negative.

There was no possibility of a postpartum infection of the child. Every precaution was taken in the institution under charge of Dr. Epstein. It seems justifiable to conclude, therefore, that the tubercle bacilli were introduced into the child in utero or during delivery, probably the former. The case was probably one of congenital tuberculosis.

Case 3. Patient, aged thirty-two years, tripara. (Previous children healthy.) She was delivered, by forceps, of a male infant that weighed 2,520 grams. It was sent immediately to Dr. Epstein's institution. The mother died three weeks post partum. Autopsy showed chronic pulmonary tuberculosis, tuberculosis of the peribronchial glands, tuberculous ulcers of the larynx, trachea, intestines, chronic tuberculosis of the liver, spleen, and kidneys. The child was living and well five months after birth.

The placenta measured seventeen centimeters by eighteen and weighed 570 grams. Some material from the placenta was injected into the abdomen of a guinea pig, which became very ill; the right inguinal glands swelled to the size of a pigeon's egg, but the animal gradually recovered and the swelling disappeared. Autopsy showed no pathologic conditions. Only after very careful searching was the first tuberculous focus found histologically; this was an infarct, in whose periphery round cell infiltration and tubercles in villi were found; many tubercle bacilli and Langhans' giant cells were present. Notwithstanding this, positive

histologic findings and animal inoculations were negative; this was probably due to the fact that the portions of tissue used happened to be free from tubercle bacilli. This case shows that not only is a negative inoculation result no proof of the freedom of the placenta from tuberculosis, but also that a normal, tubercle bacilli free child may be born with a tuberculous placenta.

Case 4. Patient, aged twenty-five years and bipara, was spontaneously delivered of a male infant, which weighed 2,570 grams. The child was not separated from its mother and died one month after birth. Autopsy showed chronic gastric intestinal catarrh, icterus universalis. The mother, at the time of delivery, had tuberculous ulcers on both tonsils and involvement of both apices. The placenta measured eighteen centimeters by twenty and weighed 680 grams. A false knot, the size of a hazel nut, was found in the umbilical cord near the placental attachment. Microscopic examination of this showed the swelling to be due chiefly to the presence of inflammatory infiltration in the vessel walls and surrounding jelly of Wharton. The veins were more involved than the arteries. In the intima of the veins, in the midst of this inflammatory tissue, a group of three tubercles was found; in one of these was a typical giant cell with two tubercle bacilli. Numerous other scattered giant cells without bacilli were found in the walls of the veins and arteries. Examination of the placenta showed a similar round cell infiltration in the walls of the larger vessels, but no tubercle bacilli. Only a few pieces of placental tissue were examined, however, as the remainder was lost.

Case 5. Patient, aged twenty-nine years and septipara, had four children who were living and well. Induction of labor in the eighth month on account of the condition of the patient. Male premature infant which weighed 1,160 grams and died in four hours. Autopsy showed debilitas congenita vitae and partial atelectasis. The mother died three weeks post partum. Autopsy showed chronic pulmonary tuberculosis, chronic serofibrinous pleuritis, chronic tuberculosis of the peribronchial and cervical lymph glands, chronic tuberculosis of the larynx, tuberculous ulcers of the small intestine, and chronic tuberculosis of the mesenteric glands. Three guinea pigs were injected; one with blood from the umbilicus, negative; one with material from fetal organs, negative; one with material from a yellow white nodule from the maternal surface of the placenta, a smear preparation from which had shown a few tubercle bacilli. This animal developed general tuberculosis. No tubercle bacilli were found upon histologic examination of the placenta, but one bacillus was found against the internal surface of the wall of a vein in the decidua basalis. No tu-

bercle bacilli were found upon histologic examination of the fetal organs, bone, marrow, or lymph glands, although numerous acid fast bacilli were present in these organs; however, their morphology did not correspond to that of the tubercle bacillus. (Probable contamination.) There were, nevertheless, marked changes found in the lymphatic system—enormous dilatation of sinuses of the lymph glands; enlargement of afferent and efferent lymph vessels. This condition suggests the possibility of circulatory disturbances of the placenta, or may perhaps be due to the presence of toxic substances—bacterial toxins which have been transmitted from mother to child.

Case 6. Patient, aged twenty-eight years and bipara, had had two miscarriages. Induction of labor as in preceding case. Dead female child weighed 1,370 grams. The patient showed advanced laryngeal tuberculosis, involvement of the left pulmonary apex. Autopsy of child showed atelectasis of lungs of premature infant. Several cubic centimeters of umbilical cord blood were injected into two guinea pigs at time of delivery, and several cubic centimeters of salt solution extract of the placenta into two others. In about three months the animals became ill; killed after four months and all showed extensive tuberculous lesions. Histologic examination of the placenta and umbilical cord was negative; the same result with the fetal lungs, thymus, spleen, kidneys, adrenals, stomach, intestines, inguinal and peribronchial lymph glands. A tubercle bacillus was found in the adenoid tissue; in one retroperitoneal gland, a bacillus was found in the lumen of a dilated lymph sinus. No tubercles or giant cells.

The infection of the lymph nodes must have occurred by one of two routes—either directly by means of emboli, or indirectly through the lymph. The latter is probably the more important. It is quite possible, as numerous authors have demonstrated, for tubercle bacilli to lie dormant in the lymph glands for a considerable time without causing typical lesions. In this case, the fact that, notwithstanding the presence of tubercle bacilli in the circulation and in the lymph glands, there was no evidence of tuberculous changes in the organs of the fetus, may be explained on the theory that infection had occurred just before birth, and that bacteria had not had time to cause lesions; but Sitzenfrey is inclined to apply here Bail's aggressin theory—invasion of the fetus occurred only after it had acquired from the previously received tuberculosis aggressins an immunity, whereby it was in a position to resist infection and either destroy completely the tubercle bacilli, or force them into a long period of latency.

TUBERCLE BACILLI IN FETUS AND PLACENTA WITHOUT HISTOLOGICAL CHANGES

Undoubted Cases.—Diagnoses rest upon the demonstration of the bacilli by staining or by inoculation of animals.

Warthin and Cowie.¹² Woman in fifth month of pregnancy, with chronic tuberculosis of kidney and general miliary tuberculosis; abortion; death; tuberculous thrombosis of placental sinus and intervillous spaces; tuberculosis of placenta; tuberculous thrombi in fetal blood; presence of free tubercle bacilli in fetal circulation, with histologic changes.

Leuenberger²⁰² reports two cases of acute miliary tuberculosis of the mother, in which miliary tubercles were found in the placenta. Tubercle bacilli were present in the fetal circulation. There were evidences of injury to the placental blood vessels.

Landouzy and Martin.²⁰³ Mother died of tuberculosis in the fifth month of pregnancy. Portions of the placenta and twenty-five drops of blood from the fetal heart, inoculated into three guinea pigs, produced tuberculosis in the latter in four months. Three other guinea pigs inoculated with portions of the fetal liver, lung, and brain, respectively, were negative for tuberculosis.

Landouzy and Martin.²⁰³ A portion of the lung of the six and a half months fetus of a tuberculous mother, dying a few days after delivery, was inoculated into the peritoneal cavities of guinea pigs. The animals died of general tuberculosis four months afterward.

Huguenin.²⁰⁴ A woman of thirty-six years of age died of advanced phthisis florida during the sixth month of pregnancy. Tubercle bacilli had been present in the sputum. An autopsy showed the usual characteristics of this disease and tubercle bacilli were recovered from the blood. The uterus was enlarged, rising as high in the abdomen as the umbilicus. The placenta and child were macroscopically normal, but tubercle bacilli were recovered from the fetal blood.

Charron and Karth.²⁰⁵ Guinea pig inoculated with portions of placenta from tuberculous mother. The result was positive. No tuberculosis was demonstrated in the child.

Herrgott.¹⁰³ Woman dying of chronic pulmonary tuberculosis in sixth month of pregnancy. Inoculation of guinea pigs with amniotic fluid was positive. This is the first case of the kind recorded.

Schmorl and Birch-Hirschfeld.¹²⁴ Seven months fetus removed by cesarean section from mother, twenty-three years of age, dying of miliary tuberculosis. Tubercle bacilli found in the fetal liver, in intervillous

spaces, and in chorionic villi. No histologic changes of tuberculosis were observed. Inoculation of guinea pigs with portions of fetal liver were positive.

Landouzy.²⁰⁶ Case 1. The seven months' fetus of a tuberculous mother showed no histologic changes. Inoculation of guinea pig with portions of fetal organs gave positive results. Case 2. The five months fetus of mother dying of tuberculosis presented no histologic changes. Placenta apparently normal. Inoculations with portions of placenta and heart blood of fetus were positive; inoculations with fetal liver, doubtful; inoculations with portions of lung and brain were negative.

Aviragnet.²⁰⁷ The seven months fetus of mother dying of acute miliary tuberculosis showed no histologic changes. Tubercle bacilli were demonstrated in the fetal blood. Inoculation of guinea pig with portions of placenta and fetus gave positive results. This case is somewhat similar to the one of Schmorl and Birch-Hirschfeld.

Thiercelin and Londe.²⁰⁸ Mother died of pulmonary and intestinal tuberculosis fourteen days after delivery. Child died on fourth day. Numerous tubercle bacilli were found in the fetal liver, spleen, and kidneys. No histologic changes found. Inoculations of guinea pigs with blood from umbilical cord were positive.

Londe.²⁰⁹ Case 1. Mother died of acute miliary tuberculosis eight days after abortion. No tuberculous changes of tubercle bacilli were found in the fetus. Inoculations of guinea pigs with portions of liver and placenta, and with fetal blood, were positive. Case 2. Mother died with advanced tuberculosis. Infant died ten days after birth. No macroscopic or histologic evidence of tuberculosis was found in the fetus. Guinea pig inoculations with venous blood, portions of fetal organs, and placenta were positive.

Schmorl and Kockel¹⁹⁶ report three cases of abortion in mothers suffering from general tuberculosis. No histologic changes were found in the fetus in any one of the cases. In one case tubercle bacilli were found in the fetal liver, periportal tissue, and lymph glands by staining methods. The placenta in each case contained bacilli and tubercles. The inoculation with portions of fetal organs was negative in all three cases.

Bugge.¹⁶² Eight months fetus of mother with miliary tuberculosis lived but thirty hours after birth. Mother died shortly afterward. Tubercle bacilli were found in the blood from the umbilical vein and in the liver vessels. No histologic changes found. Three guinea pigs inoculated with blood from the umbilical vein. Portions of fetal liver and lung gave positive results.

Londe.²⁰⁹ The mother died of tuberculosis ten days after delivery. No autopsy was performed, but the diagnosis was beyond doubt. Portions of the placenta were inoculated into guinea pig. The animal subsequently died of tuberculosis. The infant died, but no autopsy was obtained.

Doleris and Bourges.²¹⁰ Mother died of acute miliary tuberculosis three weeks after delivery of a seven months child. The marasmic infant died five weeks after birth. No tubercle bacilli or histologic changes of tuberculosis found in child by staining methods. The inoculation of a guinea pig with the heart blood of the child gave a positive result. The fact that the child's blood should contain bacilli for five weeks without occurrence of tissue changes is most remarkable. The case is doubted by Hauser and Cornet.

Kynoch.²¹¹ Patient aged twenty-eight years and primipara. She had symptoms of rapidly advancing phthisis for six weeks. Fever of 102° F. She was three months pregnant. Death occurred from tuberculosis. Postmortem showed macroscopic lesions resembling tuberculosis (nodules) in the lungs, liver, and peritoneum. The adnexa were adherent, but the tubes were patulous. The placenta was studied with gray, non-caseous tubercles. The fetus was macroscopically normal. No histologic or bacteriologic examination was reported.

Armanni.²¹² Mother died of tuberculosis in seventh or eighth month of pregnancy. Fetus showed no histologic changes. Portions of spleen, liver, and brain were inoculated into two guinea pigs. One died four months afterward of general tuberculosis; the other not affected. Secondary infection of pig not excluded.

Thiercelin and Londe.²⁰⁸ Mother died fourteen days after delivery. Had pulmonary and intestinal tuberculosis. Child died a few days after birth. No autopsy. A portion of the placenta was placed in the peritoneal cavity of guinea pig and gave positive result. Actual condition of child not known.

Bar and Renon.⁸⁴ Five cases of tuberculous mothers. The blood of umbilical vein was injected immediately into guinea pigs. Three cases gave negative results; two were positive. Of the latter, one case showed no apparent lesions in placenta and fetus, and no tubercle bacilli could be demonstrated by staining methods. Mother was in the last stage of pulmonary tuberculosis. Three animals were inoculated with pieces of liver and lung and with peritoneal fluid. The ones inoculated with portions of liver and lung tissue had general tuberculosis; the one inoculated with peritoneal fluid had tuberculosis of spleen.

Case 2. This case is open to grave doubt, as secondary infection

was not excluded. Mother had tuberculous cavities in lungs. Child died of bronchopneumonia on the fortieth day after birth. Placenta appeared normal. Two guinea pigs were inoculated with blood from umbilical vein; one was negative; the other developed local and general tuberculosis.

Bolognesi.²¹³ Portions of 13 placentas from tuberculous women, and in a few cases portions of the fetus also, were examined for tubercle bacilli. In eight cases in which the fetus was examined histologically and animals inoculated, no histologic changes were found. In only one case the inoculation with placenta was positive. The report is inexact and contradictory.

Henke.²¹⁴ Mother had chronic tuberculosis. Child died four days after delivery. Autopsy showed pneumonia with fresh, fibrinous pleuritis. No microscopic changes of tuberculosis. Portions of an apparently healthy bronchial gland were inoculated into guinea pigs. The pig showed general tuberculosis on the thirty-seventh day. Neither histologic changes nor tubercle bacilli could be found in serial sections of another gland. Henke excludes accidental infection of inoculated animal and regards case as a typical tuberculosis inoculation.

Kurbitz²¹⁵ reports a case of tuberculosis of the decidua basalis from the Marburg Pathological Institute. The patient suffered from chronic pulmonary and laryngeal tuberculosis and died three days after a confinement in the eighth month. The child weighed only 1,880 grams and was delicate. It showed no signs of tuberculosis and was negative to the tuberculin reaction. It died at three months of age from volvulus, and autopsy showed no signs of tuberculosis. The autopsy in the mother showed the lungs and larynx involved and several small ulcers near the ileocecal valve and tubercles in the liver. At the placental site was a dark red blood clot to which numerous red thrombi were attached. Macroscopically this did not show disease, but under the microscope typical tuberculosis was present. The superficial zone of the placental site was thickly crowded with miliary tubercles. These did not appear to have penetrated any vessels, although in many areas they were actually approximated to the vessel wall. The thrombi, which were numerous, did not in themselves show tuberculosis, nor was there any marked inflammation in the basal decidua. Tubercle bacilli were demonstrated in the membranes. The placenta proper could not be investigated.

Rielander and Mayers.²¹⁶ The patient was twenty years of age and had been suffering from pulmonary phthisis for some years. At the time of admittance to the hospital, the sputum contained numerous typical tubercle bacilli. The disease was progressing rapidly. A vaginal hyster-

ectomy was performed. Death followed. The decidua presented a well marked tuberculous inflammation, and tuberculosis of placenta was also present. Tubercle bacilli were demonstrated by the Ziehl-Neelson stain.

CONCLUSIONS

Congenital Tuberculosis.—1. This is a rare condition; a number of authentic cases have, however, been recorded. That transplacental infection is most likely to occur in the last few weeks of pregnancy and especially as a result of uterine contraction during labor, together with the well known latency of tuberculosis, are facts which are suggestive that this variety of infection may in some instances be mistaken for a postnatal infection.

2. As a result of congenital infection, the liver and adjacent structures, especially the lymph glands, are the localities most frequently attacked.

3. The prognosis in the congenitally infected is unfavorable; first, because of the vital character of the organs usually involved; and secondly, owing to the virulent type of organism usually present, maternal bacillemiæ rarely being found, except in a virulent type of infection.

4. For a congenital hemogenic infection to occur, a maternal bacillemia and a permeability of the placenta must precede the condition.

5. Whether tubercle bacilli can be transmitted through the normal placenta is still undetermined; certainly, when lesions are present the placenta cannot be regarded as a secure filter.

6. Preëxisting lesions in the placenta, especially those produced by syphilis, are predisposing factors to the transmission of tubercle bacilli.

7. Lesions in the placenta may be produced by the tubercle bacilli themselves, which may result in conditions favoring the transmission of organisms to the fetal circulation.

8. The presence of tubercle bacilli in the placenta is undoubtedly of more frequent occurrence than was formerly believed, and, in view of the results obtained by recent investigations, a more thorough study of the question of the frequency of congenital tuberculosis is desirable.

9. Until a fairly large series of fetuses and newly born infants can be thoroughly studied by carefully performed histologic and inoculation methods the relative frequency of this type of infection cannot be determined.

10. The presence of tubercle bacilli in the placenta by no means infers a congenital infection, but is undoubtedly a predisposing agent.

11. Congenital tuberculosis can be experimentally produced in animals, but only in a small percentage of cases, and even then as a rule only by the injection into the mother of what are relatively enormous quantities of a pure culture of tubercle bacilli. Such results can hardly be compared with what occurs in the pregnant tuberculous woman.

12. Animal inoculation is the most reliable method of testing for the presence of tubercle bacilli, either in the placenta or fetus.

13. The animals should be tested with tuberculin before inoculation and carefully guarded from possible extraneous infection subsequently to injection.

14. As an additional safeguard, a second series of animals should be inoculated from those dead of the primary injection. This should be performed for the purpose of positively determining the virulence of the microorganisms, as it is, at least theoretically, possible that dead tubercle bacilli might be present. This precaution was adopted in many of our cases, and in all in which there was the least ground for doubt. It was positive in all cases.

15. Whereas the anti-formin method is of value, the acceptance of one or two acid fast bodies morphologically similar to the tubercle bacillus demonstrated in a large series of slides is unreliable.

16. In certain types of maternal tuberculosis, tubercle bacilli are not infrequently present in the placenta. Undoubtedly the most frequent period at which transplacental infection occurs is during labor; for this reason the umbilical cord in these cases should be tied as soon as possible, certainly without waiting for the pulsation to cease.

17. The child should be taken away from the mother immediately and carefully guarded against postnatal infection.

Placental Tuberculosis.—1. Placental tuberculosis may result from the infection of the spermatozoön or ovum. This assumption is based upon theoretic grounds only and such an instance is probably extremely rare, too rare to have much practical importance.

2. Placental tuberculosis may result from a direct extension from a nearby focus, such as a preëxisting endometritis. This also is probably a comparatively rare variety.

3. Placental tuberculosis may result from a hemogenic infection. This is the most frequent variety. It requires a maternal bacillemia, a condition which in itself is comparatively infrequent.

4. Bacillemiæ are most frequently present in the acute miliary form of tuberculosis; when ulcerative lesions break into adjacent blood vessels; when hyperpyrexia is present—a condition which tends to impair the integrity of the blood vessels; and during acute exacerbations of the

disease. It is worthy of note that, in the tuberculous woman, pregnancy frequently produces an exacerbation of the disease and results in conditions favorable for the production of a bacillemia.

5. Tubercle bacilli are frequently present in the placenta without macroscopic lesions, as proven by our own investigations and those of others. This is a much more frequent condition than are actual macroscopic lesions.

6. Tubercle bacilli, when found in the placenta, are frequently virulent.

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CHAPTER V

INFECTION IN GENITAL TUBERCULOSIS

Routes of infection in genital tuberculosis—Primary genital tuberculosis—Modes of infection—History of cases—Relative infrequency in women—Analysis of literature—Summary of experiments—Clinical proof—Secondary genital tuberculosis—Latency of the disease—Determination of source of infection—Difference of opinion regarding frequency of primary and secondary infections of female genital tract—Study of cases—Summary—Predisposing causes—Frequency—Histologic examination.

ROUTES OF INFECTION

Primary Genital Tuberculosis.—Tubercle bacilli may gain access to the genital tract in a number of ways. A phthisical patient may contaminate a douche nozzle or other article with sputum or other infected material, which may be brought in contact with the genitalia, and thus produce what is to all intents and purposes a primary genital tuberculosis. This auto-infection, endogenous, or primary-secondary infection, as it is termed by Pozzi,¹ is, however, more theoretical than practical, for it is impossible to positively exclude the hematogenic or lymphogenic route under such circumstances, unless an autopsy is performed. Even then it is often difficult. Under the latter conditions more or less well developed areas of tuberculosis are often found along the route of the infection, if the case has been one of hematogenic or lymphogenic type. Sachs² has very properly pointed out that the term "primary genital infection" *should be reserved for those cases in which no other focus of tuberculosis exists within the patient's body.* The difficulty in positively determining this point has already been referred to, and makes this classification faulty, as in many cases this cannot be positively ascertained. The fact, however, that primary genital infection may occur shows that the primary-secondary infection is possible and should lead to prophylactic measures being instigated in tuberculous women.

On account of the frequency of tuberculosis, especially pulmonary phthisis, its well known latency, and the fact that small lesions not infrequently heal, certain writers have doubted the existence of primary genital infection. Primary genital tuberculosis by direct infection from without is extremely rare, and many of the examples of this condition

found in literature are not above suspicion. Aman³ rightly holds that marriage with a tuberculous man offers more chances of infection through the respiratory or alimentary tract than through the genital apparatus. In proof of this assertion, he points to the fact that the tubercle bacillus is non-motile and can, therefore, only follow the secretion current which in the uterus and vagina is outwards. He states that in rare instances primary genital tuberculosis may occur in young children by direct infection. Even were we to admit all of Aman's conclusions, many of which are not borne out by our knowledge of the action of tubercle bacilli in other parts of the body, we must remember that it is at least possible for the organism to gain access to the endometrial cavity by adhering to spermatozoa, which can readily make headway against the outflowing secretions of the genital tract. Veit,⁴ after an instructive dissertation on tuberculosis of the female genital tract, summarizes his remarks as follows: (1) Tuberculosis of the female genital tract is more frequent than is generally thought. (2) There is a primary form, but the secondary is the more frequent. (3) The infection is usually a descending rather than an ascending one. (4) Recovery may occasionally occur spontaneously. (5) The best treatment of the primary form is extirpation. (6) In the secondary forms the treatment should be directed toward improvement of the general health and operative intervention in selected cases.

Gutierre⁵ at the same meeting gave an account of some original work, the results of which strongly favored the theory of primary infection in certain cases. Von Rosthorn⁶ emphasizes the rarity of the primary form and the difficulty of positively excluding other tuberculous lesions. A similar statement is made by Wiener.⁷ Blau⁸ examined 36 cases from Chrobak's clinic and failed to find a single one which he would accept as primary. That primary genital tuberculosis occurs is now well recognized and is practically proven by the many cases which have been recorded, in which no other lesions, except those observed in the genital system, have been found, even when careful autopsies were performed. Assurance of it is strengthened by the fact that frequently, when the genital focus has been removed by operation, perfect health has been maintained for long periods.

That wound infection by the tubercle bacillus is not particularly infrequent is well known. Holt⁹ has collected 16 cases of tuberculosis acquired through ritual circumcision, infection by tattooing has been recorded, and numerous other instances of wound infection are on record. When tuberculous lesions are present in the genitalia of a man, the micro-organisms must not infrequently be introduced into the vagina

and on the external genitalia of the wife. It seems also to be proven that in rare instances tubercle bacilli may be found in the spermatic fluid of tuberculous men whose genital tract is healthy. Doubtless the reason that primary genital tuberculosis in women whose husbands have tubercle bacilli in their spermatic fluid is so rare, lies largely in the protective properties of the vagina, which is lined by multiple layers of squamous epithelium that offers an excellent protective barrier against infection of any kind. The bactericidal properties of the vaginal secretion have also been amply proven by Dubendorfer,¹⁰ Pankow,¹¹ Menge,¹² and many others. Numerous animal experiments have been carried out, most of which tend to show that virulent tubercle bacilli may be deposited on the normal vagina without producing infection, but that, if the vaginal mucosa be traumatized or an inflammation be present, a route of ingress is produced and infection may result. In subsequent pages these experiments will be reviewed more fully. It is only in extremely rare instances, if ever, that tubercle bacilli deposited in the normal vagina produce lesions.

Much has been written upon the question of coitus as a mode of primary genital infection. Infection by coitus may be taken as a type representing all forms of direct genital infection. Cohnheim¹³ was the first to suggest this form of infection. Three years later Verneuil¹⁴ stated that tuberculous men with sound genital organs might transmit the infection. As is well known, genital or urinary tuberculosis in men is by no means infrequent, and numerous cases have been recorded in which the husband is supposed to have infected his wife in this way.

Veit⁴ and Martin¹⁵ state that tuberculosis of the male genital tract occurs in three per cent of all cases. The positive proof that infection has been transmitted by coitus is extremely difficult to obtain. Tubercle bacilli are frequently found in the seminal discharge of tuberculous men. When a tuberculous epididymitis or orchitis is present, the seminal discharges almost invariably contain tubercle bacilli, while in some cases, notably those of d'Aubeau,¹⁶ the discovery of the bacilli in the semen, without any lesions in the genitalia, was the first evidence of phthisis. Jani¹⁷ and others have recorded finding tubercle bacilli in the testes of phthical men in whom no demonstrable genital lesions were present.

On theoretic grounds, tubercle bacilli, circulating in the blood, should not gain access to the testicular or prostatic fluids, but should be enmeshed in the fine capillaries leading to the glandular structures of these organs; but Grawitz¹⁸ has demonstrated that corpuscles and mold germs (which are larger than tubercle bacilli) may, under certain circumstances, reach the testicular secretion from the blood stream. Murphy¹⁹ points

out that it is sometimes extremely difficult to diagnose tuberculosis of the seminal vesicle, and suggests that under conditions such as have just been mentioned, tuberculous genital lesions may have been overlooked. Rohlff²⁰ and Westmayer²¹ have demonstrated that tubercle bacilli are rarely present in the spermatic fluid of tuberculous men, unless genital lesions are present. The former inoculated goats and rabbits with the spermatic fluid obtained from ten men who died of phthisis, with negative results. The latter injected ground up particles of the testicles and ovaries, of patients who had died of tuberculosis, into the peritoneal cavity of rabbits, with similar results in 14 observations. Dobrolonski²² tested the contents of the seminal vesicles of 25 men who died of phthisis, by means of smears and inoculation. Twenty-four were negative and the one positive result was obtained from a subject in whom a tuberculous epididymitis was present. Walther²³ examined 161 sections from the testes, 48 from the epididymis, 63 from the prostate, from the bodies of twelve phthisical men, without finding a single tubercle bacillus.

Murphy¹⁹ reports a case of tuberculous salpingitis, in which the infection is supposed to have been transmitted by coitus. He remarks, however, upon the infrequency of this mode of infection. Derville²⁴ reports the histories of 8 cases, all of which are suggestive of this variety of infection. Fernet and Derville²⁵ and Sheills²⁶ report similar cases.

The relative infrequency of genital tuberculosis, in women whose husbands are known to be the incumbents of tuberculous genital or urinary lesions, seems to be a proof that the simple deposition of virulent tubercle bacilli in the vagina is not productive of tuberculosis in the female generative organs under ordinary circumstances. Many experiments have been performed with the view of determining this point, and more or less contradictory results have been obtained. After having studied the somewhat voluminous literature upon this subject and carefully analyzed the results obtained, no one can fail to be impressed with the fact that virulent tubercle bacilli, when deposited within the normal vagina, do not, under ordinary circumstances, produce either local or general lesions, but that some trauma, loss in continuity of the vaginal lining, or special susceptibility of the new host, is necessary before the tubercle bacilli can produce pathologic changes. The vagina and portio vaginalis are invested by multiple layers of stratified squamous epithelium and differ but little in their histologic structure from the skin. Indeed, histological investigation tends to prove that the vaginal lining is a modified skin and is in no sense a mucous membrane. In the course of ordinary, modern life, tubercle bacilli are probably frequently brought in contact with

the exposed surfaces of the body, and in phthisical individuals, unless the strictest prophylaxis is enforced, the patient's skin must very often be contaminated; yet tuberculosis of the skin, resulting from this form of infection, is extremely infrequent. The outward flow of the vaginal and uterine secretions, the general, downward direction of the genital canal which favors drainage, and the more or less occlusive cervical secretion in the canal with the bactericidal properties of the vaginal secretion, all doubtless play a part in preventing the ascent of the non-motile tubercle bacilli which must occasionally be deposited in the vagina of women, the wives of tuberculous men. The relative frequency with which genital tuberculosis develops after abortion or labor, and its infrequency in wives, the husbands of whom are known to have genital or urinary lesions and who must frequently be exposed in this manner to the action of the tubercle bacilli, is further clinical proof of this assumption.

Bull²⁷ relates an interesting case bearing upon this point. A man contracted tuberculosis in his youth, later married, and at the end of one year a healthy child was born. Two years later it was necessary to remove the right testicle and epididymis for tuberculosis. At this time the left testicle was also diseased, but was spared. One year later the prostate became involved. No further operative treatment was instigated. Examination of the spermatic fluid at this time showed the absence of the characteristic odor and of the Florence reaction; an injection into guinea pigs was positive for tuberculosis. During this period of advancing genital infection, the wife had borne two children. These children showed no evidence of tuberculosis and were negative with the Von Pirquet test. The wife presented no symptoms of genital infection.

Undoubtedly infection by coitus may occur in a number of ways. As already mentioned, the spermatic fluid may contain virulent tubercle bacilli, either as a result of an internal genital lesion, or from the urinary tract. The penis itself may be the seat of a tuberculous ulcer, or the organism may be upon the external surface of a normal male organ.

Numerous animal experiments have from time to time been performed in an effort to determine the effects produced by the deposition of tubercle bacilli into the vagina. A *summary of these experiments* shows that (1) Tubercle bacilli when deposited in the normal adult vagina rarely if ever produce lesions. (2) When, however, the vaginal lining has been traumatized and there is loss of continuity of the lining membrane, infection may occasionally occur. (3) Similar results are likely to take place, if the vaginal lining has been inflamed, either by chemical or bacteriologic means. (4) Pregnancy and the puerperium favor in-

fection, especially the latter. (5) When infection occurs it may be local, distant or a general tuberculosis may be set up. The amount or character of the trauma or irritation does not seem to be a guide in this respect. (6) Tuberculosis may result from the spread of the microorganism in the vagina to distant parts of the body without producing local lesions. (7) The route of the infection appears to be through the lymphatics, the pelvic glands usually being involved. (8) Local infection occurs in only the minority of cases. (9) Young animals seem to be slightly more susceptible than old. (10) When tubercle bacilli are deposited within the uterus, the percentage of infections is increased. For further details of research on this subject, the reader is referred to the works of Cornet, Flugge, Dobrolonski, Cornil, Oncarani, Basso, Jung and Bennecke, Blau, Varaldo, Andrews, Sugimura, Hartmann, Williams, Gorovitz and Popov.

In view of the above clinical and experimental evidence it appears to be an established fact that in rare instances tuberculosis may be spread by coitus. Precautions are, therefore, indicated, particularly in those cases in which there is a tuberculous lesion in the genito-urinary tract.

As has already been stated, tubercle bacilli may be deposited in the genital tract in a number of ways: coitus, septic instrumentation, infected fingers, douche nozzles, dressings, etc. All these should be guarded against. In not a few cases, lesions of the lower genital tract have been attributed to tubercle bacilli bearing endometrial or tubal secretions. A number of cases have been recorded in which the genital lesions were plainly the result of infected discharges from tuberculous intestines, the access of the tubercle bacilli being gained to the genital tract through a rectovaginal, or other form of fistula. The tubercle bacilli may also gain access to the genital tract through contamination of the latter by diarrheal discharges, the result of tuberculous lesions in the alimentary tract. In the same manner genital tuberculosis may result from tuberculous lesions in the urethra, kidney, ureter, bladder; or the lower genital tract may be contaminated by discharges originating from a salpingitis or endometritis. It will be noted that a large proportion of the above mentioned lesions produce conditions which result in constant and prolonged irritation, and that in many cases, as a result of the discharges, a local inflammatory reaction results. This is probably a factor in lessening the resistance of the parts and thus making them more susceptible to the action of the tubercle bacilli. Another method of infection is by direct extension. Thus the genital lesion may be due to a direct extension of a tuberculous focus in the bowel, bladder, or other adjacent structure, either by way of a fistula or through adherent inflammatory structures without actual macroscopic loss of continuity. The infection, espe-

cially of the tubes, may and frequently does follow tuberculous peritonitis. The question, under such circumstances, which is the primary lesion, is sometimes difficult to determine. Tuberculosis of the adnexa may result from a direct extension from a peritonitis, from a deposition by the peritoneal currents of tubercle bacilli in the peritoneal fluids, or may be purely secondary infection resulting from a lymphogenous or hematogenous origin. These three possibilities are of more theoretic than practical importance. The works of Muscatello,²⁸ Clark and Norris,²⁹ and others have amply proven that the general direction of the intraperitoneal currents is towards the diaphragm and that the chief absorption of the peritoneal fluids occurs in the neighborhood of the central tendon of the latter structure. When, however, the openings of the lymphatics of the diaphragm become blocked with débris, as in the case of peritonitis or ascites, absorption through this structure is greatly diminished, as has been shown by the experimental work of Waterhouse³⁰ and others. Pinner³¹ demonstrated that when powdered cinnabar was introduced into the peritoneal cavity of rabbits, a small proportion of it eventually found its way into the vagina through the tubes and uterus, and it would seem probable, therefore, that in the case of a tuberculous peritonitis, tubercle bacilli might in the same way be swept out through the genital tract and secondarily produce a lesion in the cervix, vagina or external genitalia. Jani demonstrated tubercle bacilli at autopsy in the lumen of a macroscopically normal fallopian tube in a phthisical patient. An ulceration of the intestine was also present. In this case the tubercle bacilli may possibly have been carried to the tube by way of the blood stream. Kaufmann³² was one of the first to record the history of a case in which tuberculosis of the genital tract was the result of direct infection from a tuberculous intestine and genital fistula. In his case there was a fistulous opening between the small intestine and uterus. Kraus³³ has reported a case of ovarian tuberculosis, which resulted from a similar infection of the vermiform appendix.

Secondary Genital Tuberculosis.—Under this head should be classified many of the methods of infection just described. For reasons already stated, it is sometimes extremely difficult, when two separate foci of tuberculosis are present in a patient, to determine which lesion has been the primary one. *The well known latency of the disease*, the fact that the primary lesion is not necessarily the most advanced and may have become of much less clinical severity or may even have progressed to resolution before the secondary lesion has advanced to sufficient magnitude to attract attention, add greatly to this difficulty, and make the *determination of the source of primary infection* almost impossible to

positively ascertain, unless a careful postmortem can be performed, and even then is often difficult. The study of tuberculosis in parts of the body other than the genital tract and the preponderance of this infection in certain localities, such as the lungs, may, however, to all intents and purposes, practically clear up this difficult problem. Many forms of tuberculosis are at some stage bacteriemias. When, therefore, genital lesions are present in conjunction with phthisis, the latter should be considered the primary focus.

Authorities differ widely in their opinions regarding the *frequency of primary and secondary infections of the female genital tract*. Frerich³⁴ states that, of the genital tubercloses in women, 6 per cent are primary; Mosler³⁵ places the proportion at 17.3 per cent; Späth,³⁶ at 24.5 per cent; Schramm,³⁷ 20.9 per cent; Merlitti,³⁸ at 18.6 per cent; Berkley,³⁹ 10.8 per cent; Frerichs,⁴⁰ at 15.6 per cent; and Horizontow,⁴¹ 10 per cent. Williams⁴² is of the opinion that blood infections are more frequent than generally supposed. Villard⁴³ found the lungs diseased in one half of the cases of genital tuberculosis.

For reasons already stated, the estimate of the proportion of primary and secondary genital tuberculosis is necessarily extremely difficult and cannot be accurately determined. From a study of the cases which have been treated in the gynecological department of the University of Pennsylvania, it would seem that secondary infections are by far the most frequent, probably not more than 5 or at most 10 per cent being primary. Obviously the question as to whether a given case is a primary or secondary infection is of great importance in governing the prognosis and treatment.

To summarize—Genital tuberculosis may arise in one of four ways:

1. By direct infection from without. This is a rare form, but its existence has been definitely proven both clinically and experimentally. The infective organism may come from the patient's own mouth or other lesion by way of the hands, etc., or may originate in another host and be conveyed to the woman's genital tract by coitus, septic examinations, etc.

2. Infection of the genitalia may be secondary by way of the blood stream; the primary focus may be distant or near at hand, the lungs being the most frequent site for the primary infection. This is a frequent form of genital infection.

3. Infection may result from a direct extension from a nearby focus, such as the peritoneum, intestine, bladder, etc. This also is a frequent method of infection.

4. Infection may result from a lymphatic infection, usually from a comparatively nearby focus.

Predisposing Causes of Genital Tuberculosis.—As has been stated, genital tuberculosis is more frequent in the female than in the male. This can probably be largely accounted for on an anatomical basis. In cases of tuberculous peritonitis, the tubes are naturally exposed to infection. The lower genital tract in women is also more subject to invasion by tubercle bacilli bearing discharges from the alimentary tract and from external infection in general, than are the corresponding organs in the male. Von Franque⁴⁴ and Murphy are of the opinion that tuberculous salpingitis usually results from an infection via the peritoneum. In many of our cases the reverse has been true. The congestion incident to menstruation and pregnancy and the trauma of the latter are also predisposing factors. Gonorrhea seems in many cases to prepare the soil for the invasion of the tubercle bacilli, and the same may be said of any inflammation, especially chronic ones. Loss of continuity of the surface epithelium appears in many cases to offer an entry way for the tubercle bacilli. Schuchardt,⁴⁵ Saulmann,⁴⁶ and others have directed attention to the frequency with which tuberculosis follows or occurs concomitantly with venereal diseases. The age is undoubtedly a predisposing factor, but this varies with the character of the lesion and will be considered under the description of the various organs. Hegar, Merlitti,³⁸ de Rouville,⁴⁷ Schiffmann⁴⁸ and others are of the opinion that hypoplasia of the genital organs is a strong predisposing factor to tuberculosis. A study of our series of cases has not borne out this opinion.

Frequency of Genital Tuberculosis.—Genital tuberculosis is more frequent in women than in men. According to Amann,³ 20 per cent of tuberculous lesions involve the genital tract in females and 3 per cent in males. In many cases tuberculosis of the genital tract can only be diagnosed by the microscope or by culture or inoculation, and the proportion of cases in which the macroscopic lesions are sufficiently characteristic to lead to a positive diagnosis is by no means large. Williams³⁸ states that, in his series of cases of tuberculosis of the genitalia, 75 per cent were of the "unsuspected variety" and were only diagnosed when the tissue was examined histologically. This difficulty in making macroscopic diagnoses of genital tuberculosis is probably largely accountable for the divergent results reported by various pathologists and surgeons. Thus Courts⁴⁹ found genital tuberculous lesions in 1 per cent of women dying of tuberculosis; Louis,⁵⁰ in 2.5 per cent, and Cornil,⁵¹ in 2 per cent; Kiwisch,⁵² in 2.5 per cent, and Mosler,³⁵ in 2.5 per cent; Schramm,³⁷ in 4.1 per cent; Nimias and Christoforis,⁵³ in 8.3 per cent.

Owing to the increased knowledge of the pathology produced in the genital tract by the tubercle bacilli, more recent references place the proportion of genital infection much higher. In 1901 Merlitti³⁴ placed the proportion at 12.6 per cent, which is the figure given by Foster.⁵⁴ Purefoy⁵⁵ places the proportion at 7 per cent. Martin¹⁵ stated that genital tuberculosis was present in 4 per cent of females who died of tuberculosis before puberty, in 12 per cent of those dying during the child bearing period, and in 22 per cent of those dying in later life. Berkley,³⁵ in statistics including the years between 1880 and 1902, found in 798 necropsies, performed in females who died of tuberculosis, the genital organs affected in 62, or 7.7 per cent. Simonds⁵⁶ gives the results of 6,000 portmortem examinations, which lead him to the following conclusions: Tuberculosis of the female genital tract is found in 1.5 per cent of all cases. It is most frequent between the ages of 20 and 30 years. In 87 per cent the tubes are affected, and in 76 per cent, the uterus. Meyer-Rügg⁵⁷ states that in 2 per cent of all female corpses there is found to be tuberculosis of the genital organs. Taking into account only women dying of tuberculosis, there is genital tuberculosis in 10 per cent. The value of many of the statistics regarding the frequency of genital tuberculosis is somewhat nullified by the fact that the authors fail to state whether routine histologic examinations have been made, or whether the results refer only to those cases which have presented macroscopic lesions. Probably the latter was the case in many of the statistics. Furthermore, information regarding the location of the lesion in the genital tract is not infrequently lacking. The organs of generation are involved in the following order of frequency: tubes, uterus, ovaries, vagina and vulva. This ratio holds good, whether the infection be primary or secondary. Berkley³⁵ presents the following statistics. His results are from post-mortem subjects. It is not stated whether routine histologic examination had been performed: Fallopian tubes, 30; fallopian tubes and body of uterus, 8; fallopian tubes, body of uterus, and ovaries, 5; fallopian tubes and ovaries, 4; ovaries, 4; cervix, 3; corpus uteri, 3; vagina, 2; fallopian tubes and vagina, 1; fallopian tubes, body of uterus, and cervix, 1; fallopian tubes, body of uterus, ovaries and vagina, 1. Thus, the tubes were affected in 80.6 per cent; body of uterus, 29 per cent; ovaries, 28.5 per cent; cervix, 6.4 per cent; vagina, 6.4 per cent; vulva, 0 per cent. Williams,³⁸ whose material was operative in origin and all of which was submitted to a routine histologic examination, is of especial value. He states that 8 per cent of all adnexitis cases are of tuberculous origin. In nearly all cases the tubes were involved; the uterus, in 60 to 75 per cent; and the ovaries, in 40 to 45 per cent of cases. Cummins,⁵⁸ in a series of

cases of pelvic inflammatory disease, found 10.5 per cent to be of tuberculous origin. Hannes⁵⁹ places the proportion at 4.5 per cent. Martin,¹⁵ in the routine histologic examination of lesions from the gynecological clinic at Greifswald, found 24 tuberculous specimens among 1,600 specimens. Edebohls,⁶⁰ in 157 abdominal sections, found 4 per cent were performed for tuberculosis. Horizontow⁶¹ places the order of involvement of the genital organs as follows: Tubes, 87 per cent; uterus, 47 per cent; ovaries, 15 per cent; the cervix secondarily involved with the body of the uterus, 14 per cent; cervix alone, 2 per cent; vagina or external genitalia, 6 per cent. Basing his opinion upon his own and other statistics gathered from postmortems performed upon patients dying of tuberculosis in which involvement was proved, he states that pulmonary lesions were present in 89 per cent; peritoneal lesions, 64 per cent; intestinal in 56 per cent; and lesions of the urinary tract in 42 per cent. In the laboratory of gynecological pathology at the University of Pennsylvania, where all specimens are subjected to a routine histologic examination, it has been found that 7 per cent of all the inflammatory fallopian tubes are tuberculous. Among 6,557 gynecological specimens examined in our laboratory, there was no case of tuberculosis of the external genitalia, there was 1 case of tuberculosis of the vagina, 1 case of tuberculosis of the cervix (219 specimens of carcinoma or other malignant neoplasms of the cervix, showing the relative frequency of tuberculosis and malignant tumors of the cervix, a condition for which tuberculosis is often clinically mistaken; this also emphasizes the importance of definitely excluding malignancy before making a diagnosis of tuberculosis of the region); 13 cases of tuberculous endometritis (all associated with tuberculous salpingitis), 4 cases of oöphoritis, 2 cases of tuberculosis infecting the wall of ovarian neoplasms, 7 cases of tuberculous perioöphoritis, 1 case of tuberculosis of the breast (among 166 breast tumors, 91 of which were malignant and 75 benign).

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CHAPTER VI

TUBERCULOSIS OF THE EXTERNAL GENITALIA

Etiology—Possibility of hematogenic or lymphogenic infection—Causes—Frequency—Combined statistics of many investigators—Varieties—Forms, ulcerative and hypertrophic—Symptoms—Number of cases; average age—Relative infrequency of direct infection in this locality—Parturition as causative agent—Trauma a predisposing factor—History of cases—Appearance of ulcerative variety—Hypertrophic variety—Tabulation of parts involved—Diagnosis—Prognosis—Method of treatment—Primary variety—Secondary—Doubtful cases—General treatment—Tuberculous non-ulcerative hypertrophy of vulva—Histologic examination—Tuberculosis of Bartholin's gland—Tuberculous ulcers of labia majora and minora—Histologic examination—Study of cases—Primary tuberculosis of vulva with elephantiasis of clitoris—Secondary hypertrophic tuberculosis of vulva—Reports of cases.

LESIONS

Of all forms of tuberculosis affecting the female genital tract, lesions of the external organs are the least frequent. This is probably largely due to the protective properties of the squamous epithelium with which the parts are covered. Much of the surface of the external genitalia is covered by skin, the outer layer of which possesses a moderately well defined development of horny squamous epithelium, such as is usually found on the surface of the integument. As the skin covering the external genitalia approaches the lining membrane of the vagina this outer horny layer gradually disappears.

The tuberculous lesion may be primary or secondary; the latter being by far the most common. Of fifty-seven cases, the abstracts of which are appended, 79 per cent occurred in conjunction with well marked tuberculosis of other parts of the body. In 66 per cent of these cases the genital lesions were secondary to distant foci; 33 per cent from the lungs; 5 per cent from the peritoneum, and the remainder to tuberculosis in other parts of the body. In 18 per cent of cases lesions in the upper genital tract were present.

Winckel¹ was probably the first to record an authentic case of tuberculosis of the external genitalia. Cayla's² observation appeared a short time later.

Etiology.—Lesions of the external genitalia may result from a direct inoculation, or direct extension from the vagina or adjacent structures, or from an hematogenic or lymphogenic infection. In many of the reported cases lesions of the external genitalia have apparently followed a direct implantation, the result of tubercle bacilli bearing discharges originating from the lesions in the intestinal, urinary, or upper genital tracts. In this connection, it is interesting to observe that the infection may be transmitted from the tubes to the external genitalia or vagina without the uterus becoming involved. In these cases, the possibility of an hematogenic or lymphogenic infection must be considered, although a direct implantation would appear the most likely. The relative frequency of tuberculosis of the uterus and the rarity of infection of the external genitalia is further proof, if such were required, that the simple deposition of tubercle bacilli upon the normal vagina or external genitalia seldom results in the production of lesions; for in tuberculosis of the uterus tubercle bacilli are frequently discharged through the cervix. Tuberculosis of the external genitalia may also result from a direct extension by continuity from the vagina or adjacent structures.

Trauma appears to play an important rôle in the production of secondary lesions, doubtless by producing an area of lessened resistance. In the primary form it is less frequently a factor, although a loss of continuity, by opening up avenues for direct inoculation, should be considered. Preëxisting inflammation is also a predisposing cause. In this manner the more or less constant soaking of the parts in toxin and tubercle bacilli laden discharges probably first produces a maceration of the skin, then a vulvitis and finally an actual infection by the tubercle bacilli. A number of cases have been recorded occurring in conjunction with syphilis; gonorrhea has also been present in some cases. In the young vulvovaginitis has preceded the tuberculosis in some instances.

Bulkley³ believes that, in the primary form, infection frequently occurs either by sputum or coitus. Of the secondary variety, infection may occur by the hematogenous or lymphatic route, or by contiguity of tissue or continuity of the surface. The actual route of infection is often difficult to determine in any given case. As has been stated, trauma or preëxisting inflammation apparently acts as a predisposing cause, especially in the secondary form of the disease.

Frequency.—As has been stated, this is the rarest form of genital tuberculosis. Of 6,657 gynecologic specimens in the laboratory of Gynecological Pathology of the University of Pennsylvania, but two examples of this variety of infection have been observed. Williams⁴ states that at the time of the appearance of his monograph, in 1894,

but three cases of tuberculosis of the external genitalia were found in which the correctness of the diagnosis had been verified by inoculations. The combined statistics of Geil,⁵ Mosler,⁶ Daurios,⁷ Schiller,⁸ and Martin⁹ show that among 379 cases of genital tuberculosis there was no involvement of the vulva. The statistics of Berkley,¹⁰ Simmons,¹¹ and Schlimpert¹² show that among 12,114 autopsies upon tuberculous women, genital tuberculosis was present in 215 subjects, but in none was the external genital involved. In 1903 Berkley¹⁰ was able to find in the literature but four which were above suspicion.

Varieties.—In general, vulvar lesions closely resemble tuberculosis of the skin in other parts of the body, except that they are often modified as a result of local conditions, such as moisture discharge, heat, friction and the presence of special glands and other anatomic conditions.

Bender¹³ and Patel¹⁴ recognize two forms of tuberculosis of the external genitalia—the ulcerative and hypertrophic. Of these, the ulcerative is by far the most frequent. Of the fifty-four cases, the abstracts of which may be found in the following pages, forty-four were of this type and only ten of the hypertrophic variety. Bender¹³ found the ulcerative variety almost ten times as frequent as the hypertrophic. Occasionally the hypertrophic form undergoes ulceration, generally upon the prominence of the tumor, under which circumstances the cases are usually tabulated as ulcerative. The majority of the ulcerative lesions are associated with more or less swelling. To the ulcerative and hypertrophic varieties Combeleran¹⁵ adds a third variety, which he designates as *lupus vulvae*; this is characterized by thickening of the skin and mucous membrane, occasionally taking on a verrucous aspect, or by the development of ulcerations of limited depth and extent, but sometimes without ulcerative process. This is a doubtful variety, and probably merely slightly atypical form of either the ulcerative or hypertrophic form.

Formerly, much confusion existed regarding the hypertrophic variety and many cases of elephantiasis and other forms of enlargement were considered of tuberculous origin. The contrary also probably occurs, and this would seem especially likely in view of the difficulty often encountered in correctly diagnosing the hypertrophic form, even after a careful histologic examination.

Symptoms.—The symptoms resulting from lesions of the external genitalia are in themselves generally not very severe and in the secondary variety are usually subservient to those resulting from the primary condition. Not infrequently there is a history of previous injury, this being particularly likely to be the case in the secondary variety. Thus, a fall from a horse, which resulted in injury to the vulva, occurred in the

Bender and Nandrot¹⁶ case, and the history of a fall resulting in trauma to the vulva was also present in the case recorded by Deschamps.¹⁷ In many of the cases a tuberculosis of the upper genital tract can be demonstrated, and not infrequently lesions of the lungs or other portions of the body are present. Perhaps most frequently of all, tuberculosis of the external genitalia is secondary to intestinal lesions. In the author's case the disease was secondary to tuberculosis of the hip joint. Thus, it is seen that the condition may result from a hematogenous infection, from direct implantation through tubercle bearing discharges, or even from exogenous microorganisms, and from a direct extension from adjacent foci. In Schenk's¹⁸ case the child had long associated with two playmates known to be tuberculous.

It is probable that direct inoculation from sexual intercourse may occur. The infection almost certainly came from a tuberculous husband in Rieck's¹⁹ case, and probably in Montgomery's.²⁰ The experiments of Spano,²¹ Popoff,²² and Gorovitz²³ bear out this assertion. Cornet²⁴ suggests that tubercle bacilli bearing saliva may be used as a lubricant by a phthisical husband during coitus and thus result in infection. In a previous chapter the modes of direct inoculation have been more thoroughly considered; it is sufficient here to state that in the case of a woman, the wife of a tuberculous husband, there are other and more probable channels of infection than the genital tract, although the possibility of this occurring must be considered, and should be guarded against.

While the number of cases of tuberculosis of the external genitalia tract, recorded in literature, is as yet too small to draw definite conclusions from regarding many of the symptoms, it would appear that no age is immune.

Among 39 cases, the average age was 31.82 years. The extremes are 13 months (Demme²⁵) and 88 years (Dambrin and Clermont²⁶). Arranged in decades, these thirty-nine cases show the following:

Years	Cases	Per Cent
1—10	7	18.2
11—20	4	10.2
21—30	8	20.5
31—40	12	30.7
41—50	1	2.75
51—60	4	10.2
61—70	1	2.75
71 and over	2	5.1

A family history of tuberculosis is frequently obtainable, and a history of previous or present tuberculous lesions, such as pulmonary phthises, intestinal tuberculosis, adenitis, bone lesions, or pelvic inflammatory disease, is often present. Both single and married women are attacked, the disease apparently exhibiting no marked predisposition in this respect, thus bearing out what has already been said regarding the relative infrequency of direct inoculation in this locality. For, if direct implantation by means of coitus often resulted in genital lesions, tuberculosis of not only the external genitalia, but also of the vagina and cervix, would be more frequent among married women than among spinsters. This, however, is not the case to any marked extent. Parturition, however, appears to play some part as a causative agent. In the secondary variety it is certainly a not unimportant factor. It is accepted that the parturient woman is especially susceptible to acute miliary tuberculosis, a form of infection in which secondary lesions of any sort are not uncommon. Pregnancy and parturition also exert an unfavorable influence on almost any form of tuberculosis, especially the pulmonary varieties, frequently leading to exacerbation. It is in acute infections that secondary genital lesions are most common. On the other hand, in the secondary variety of genital tuberculosis, trauma is a decided predisposing factor and the trauma incident to labor or miscarriage must, therefore, be considered apart from the fact that in the parturient state women are peculiarly susceptible to any form of infection. Montgomery,²⁹ Jorfida,²⁷ and Davidson²⁸ have recorded the history of cases which occurred shortly after delivery. The results of animal experimentation, which have been previously quoted, show that trauma and inflammation are predisposing factors to direct infection as well as to the secondary or metastatic variety.

The onset of tuberculous lesions of the external genitalia is generally slow, but progressive. Local discomfort, pain, discharge, and frequent and more or less marked dysuria are usually the most prominent symptoms; but even these are quite variable. In some cases the pain is quite marked and in others it is absent. The pain may be sharp and cutting in character or a dull ache. Most frequently, as the disease advances, the pain becomes more pronounced, and if the lesion is of the ulcerative variety and so situated that the urine flows over it, pain at or following micturition is nearly always observed. The rubbing of the clothing against the ulcer, coitus, or other trauma is frequently complained of. Not infrequently there is intense pruritus and more or less itching is generally present, as in the cases of Deschamps,¹⁷ Renaud,²⁹ and Martin.³⁰ In the hypertrophic variety the pain is less marked, the

enlargement, however, from its very size, may produce discomfort. In the ulcerative variety discharge is nearly always present. This varies, according to the stage and character of the lesions, from a thick, purulent secretion to a thin, more or less irritating leukorrhea. In acute cases or following trauma, it may be blood streaked. As a result of the discharge, a more or less general vulvitis usually occurs and sometimes produces distressing symptoms, a certain amount of pruritus being almost always present.

Many cases being secondary to tuberculosis of the upper genital tract, it is difficult to determine how much of the discharge comes from above and how much from the vulvar lesion. As a rule, the ulcers do not bleed very readily to the touch and are not markedly tender. Tubercle bacilli can occasionally be demonstrated in the discharge, especially if the lesion be an acute one. In the curettings from the surface of the ulcers they can frequently be found. Occasionally, as a result of extension of the ulcer, fistulas form. In the ulcerative variety, and sometimes in the hypertrophic, inguinal adenitis occurs. Murphy³¹ states that inguinal adenitis occurs late. This, however, depends largely upon the character and location of the lesion and upon the amount of suppuration present.

Appearance of the Ulcerative Variety.—This is generally preceded and accompanied by more or less enlargement. In the case reported by Bender and Nandrot¹⁶ the condition began as a fluctuant swelling, which finally broke down, leaving a discharging cavity which was extremely chronic in type and which exhibited little or no tendency towards spontaneous resolution. The areas surrounding the preliminary swelling are usually discolored and edematous. The adjacent tissue is indurated. After a varying length of time, sometimes many months, the swelling softens in one or more areas and breaks down. In some cases the lesion begins as one or more small firm nodules, which subsequently soften and break down. Thus a number of ulcers may be formed. These may finally coalesce, forming a single large granulating area, usually covered with a layer of necrotic tissue. The ulcer may originate as a superficial loss of tissue, and then gradually enlarges. The ulcer may occur on any part of the external genitalia, but is perhaps most frequently on the labia majora or minora. One or both sides may be involved, and contact ulcers on the opposite side are occasionally observed. The ulcers may extend backwards into the vagina or outwards over the skin, perineum, or adjacent structures. When the vagina is involved, fistulas connecting with the various adjoining hollow viscera are not infrequent and the symptoms from these are likely to be

a marked feature. Occasionally the anus is involved. Ulcers of the external genitalia vary in appearance; the margins are often elevated and swollen or the edges undermined. The base is usually moderately firm and may be covered by minute, grayish or yellowish elevations (tubercles). In some cases the floor of the ulcer is covered by a dirty, yellowish or brownish crust. An appearance of chronicity is common to the majority of these lesions. The color may be grayish, yellowish, reddish or brownish, and the surrounding skin is often chronically inflamed, discolored, hyperemic, and may contain enlarged veins. The ulcers vary markedly in size. Thus, in Legane's³² case the entire vulvar region, including the hymen, was destroyed by a yellowish ulcer. A somewhat similar case is recorded by Brault.³³

The ulcers are often serpiginous in character, healing behind as the advance is made. As a result, cicatrices may be present. In some instances, where the urethra has been attacked, the disease has apparently followed the mucosa of that canal, forming finally a funnel shaped ulcer with the small end directed towards the bladder. Reed³⁴ states that frequently the meatus appears to be torn laterally, somewhat after the manner of the Emmet denudation for trachelorrhaphy, while on the other hand almost microscopic lesions have been described.

Hypertrophic Variety.—This is an extremely rare form, and too few cases are recorded to base on them a definite description. In the cases reported by Petit and Bender, and Pöverlein the lesions were characterized by moderately large tumor-like masses, which in Pöverlein's case were at first mistaken for a sarcoma of the labia. Specimens in the cases of Petit and Bender, Forgue and Massabauu resembled an elephantiasis. The discharge is not profuse and is never purulent or sanguineous. Tubercle bacilli have never been demonstrated in it.

Bulkley³ gives the below summary regarding the parts involved. In this summary the hypertrophic and ulcerative varieties are included, from which it will be seen that the labia are most frequently involved.

Parts Involved	Cases
Vulva	10
Labia majora	29
Labia minora	30
Clitoris	8
Entire introitus	7
Posterior commissure	6
Anterior commissure	3
Mons veneris	2

Parts Involved	Cases
Edge of urethra	5
Bartholin's gland	2
Prepuce	1

Diagnosis.—A positive diagnosis without the aid of the microscope in either the ulcerative or hypertrophic varieties is impossible. Malignant tumors and syphilis are the two conditions most likely to cause confusion; although in children gonorrheal vulvovaginitis, anovulvar diphtheria, and noma vulvae must be differentiated. Chancroids can usually be readily differentiated, as can kraurosis vulvae. The hypertrophic variety usually more or less closely resembles elephantiasis. Bender³⁵ recommends biopsy in all cases in which there is ulceration, but even this is untrustworthy in the hypertrophic variety.

The Wassermann reaction should be applied to all cases, and in children the von Pirquet reaction will be of value. It should be remembered that malignant neoplasms, especially in the aged, are far more frequent than is tuberculosis, and a thorough histologic examination to exclude this possibility should be made without loss of valuable time in all cases. After excision of the suspected area the diagnosis can usually be readily arrived at. Histologic, bacteriologic, and animal inoculation will clear up all doubtful cases. For the histologic examination, it is advisable to examine slides from a number of sections, as, if only one block is taken, characteristic lesions may be absent. In the hypertrophic form tubercles are sometimes rare and only the bacilli, and these in small numbers, are found. The fact should not be lost sight of that syphilis or malignant tumors, or even both, may accompany tuberculosis.

The presence of tuberculosis in other parts of the body, grayish tubercle like elevations at the base of the ulcer, the presence of acid fast bodies morphologically similar to the tubercle bacilli in the discharge, all point to tuberculosis. In staining for tubercle bacilli the smegma bacilli must, however, be excluded. The absence of a syphilitic history and a negative Wassermann reaction will practically exclude syphilis; while the longer duration, more chronic appearance of the lesions, and the lessened tendency to bleeding, and perhaps the age of the patient, are evidence against the condition being a malignant tumor.

Prognosis.—This, as in all tuberculous lesions of the female genital tract, depends largely upon whether the lesion be a primary or secondary one. In the latter event, the primary focus will often be the more severe and the prognosis will naturally depend upon its location and character. In some cases the genital lesions are extremely chronic; thus, in Pöver-

lein's³⁶ case the disease had been present for seventeen years, in Viatte's³⁷ case, seven years, and in Montgomery's²⁰ case, five years; whereas in other reported cases rapid dissemination of the infection and death have occurred. Demme²⁵ emphasizes the rapid course that the disease may follow, especially in children. A lethal termination is, however, rarely due to genital lesions alone.

Even after apparent entire excision, recurrences may occur. On the other hand, spontaneous healing occasionally takes place, but this is unusual. More frequently the course of the disease is chronic, but progressive. Unfortunately the great majority of reports are either too recent or mention is not made of the ultimate outcome of the cases. Statistics are thus apt to be misleading. Bulkley³ in his excellent review of tuberculosis of the external genitalia, presents the following table, but warns us that the heading "healed" cannot be interpreted as an end result:

Method of Treatment	Number of Cases	Healed	Recurrence	Healed Per cent
Excision	20	13	7	65
Curettage and cauterization....	6	5	1	83
Excision with cautery.....	1	0	1	0
Cauterization	1	1	0	100
Nitric acid	1	1	0	100
Iodoform	2	2	0	100
Tuberculin	1	1	0	100
General hygiene	1	1	0	100

Treatment.—This depends largely upon whether the genital lesion be primary or secondary. In this connection, it should be remembered that in some cases this is an extremely difficult point to determine, as the manifestation of the primary lesion may be insignificant or it may have even undergone partial resolution. Under such circumstances, if the primary lesion be in the lungs and a general anesthetic be administered, the pulmonary condition may be lighted up with disastrous results. The utmost care, therefore, should be exercised and an extremely thorough physical examination be performed to determine this point. Unfortunately, the majority of cases are secondary, the primary focus usually being in the lungs or intestines, and as a rule easily demonstrated. The fact, which has been pointed out under the heading of diagnosis, that in many cases tuberculous lesions of the external genitalia closely simulate

malignant neoplasms or syphilis, and the greater frequency of these conditions, should in all cases lead to the exclusion of these as a primary step.

If the Wassermann reaction be negative, a diagnostic excision of all, or at least of part, of the suspected lesion should be performed without delay, for the purpose of excluding malignant tumors. An exception to this may exist in certain cases in early life and in those cases in which the patient is clearly doomed as a result of an advanced primary lesion. The diagnostic excision may, if it is thought advisable, be performed under local anesthesia, and the cautery knife, heated to a dull red, should be employed. Bloodgood³⁸ has shown that in cases of malignant tumors excision of the suspected area with the cautery knife, heated to a dull red, or immediate cauterization of the wound after excision is much less likely to be followed by dissemination. If the lesion is small or easily removed, it is preferable to excise in toto and thus exclude, as fully as can be done, the possibility of this danger.

The general trend of the modern scientific opinion is towards surgery in the treatment of these cases, followed by general hygienic measures, preferably carried out in a sanitarium. In all cases the anesthetic should be chosen with great care and it is a safe rule in this respect to treat all, even supposedly primary cases, as if they were the incumbents of a lung lesion. In all cases a thorough pelvic examination should be performed to determine whether adnexal lesions are present.

The treatment naturally divides itself into that of the primary and secondary cases, and into a third class in which this point cannot be positively determined.

PRIMARY VARIETY.—In these cases a radical extirpation is indicated. The character of the operation will naturally vary with the individual case, but an attempt should always be made to excise a wide margin of healthy tissue. Except in the aged, care must be exercised not to unduly narrow the vaginal orifice. In some cases, when the lesions are extensive, plastic operations to supply the excised tissues may be necessary. Excision of the inguinal lymphatic glands, if these are enlarged or have given symptoms, should be a part of the operation. The question of the excision of the glands, when these are not enlarged or have not produced symptoms, is still undecided. Under the latter circumstances probably the best course to pursue is to cease the operation after the excision of the genital lesion and keep the patient under observation. Should the histological examination reveal a malignant tumor instead of tuberculosis, the glands may be excised at a second sitting, and if necessary a wider excision of the genital lesions can be performed.

SECONDARY VARIETY.—The treatment of these cases depends largely upon the character of the primary lesion and the severity of the symptoms produced by the genital condition. No hard and fast rule can be formulated for the treatment of this class of cases, each of which must be judged individually. If the primary lesion is mild and the general condition good, total excision of the genital process is almost always indicated. The location of the trouble, its size, mobility, rapidity of growth, the amount of discomfort that it is producing, the character of the operation required, and more especially the variety and location of the primary lesion and the general condition of the patient, are all factors which must be taken into consideration.

In the majority of the secondary cases excision of the genital lesion is advisable for three reasons, (1) for its palliative effect, (2) exclusion of malignant tumors, (3) the primary lesion may subsequently be cured. If excision is rejected, curettage and cauterization of the ulcerative variety should usually be performed. After curettage a free application of the thermocautery is advisable; if this is impossible, application of phenol or the pure tincture of iodine, the latter repeated daily for five or six days, is indicated. Patal¹⁴ recommends the application of lactic acid and employs this in all cases in which total excision cannot be performed. Veit³⁹ strongly recommends iodoform as a palliative agent. Bender¹³ urges excision for its palliative effect in nearly all cases. Especially is excision indicated in the hypertrophic form of the disease.

DOUBTFUL CASES.—Occasionally, as has been mentioned, cases will be encountered in which it is impossible to determine whether they are primary or secondary, even after a thorough examination. These cases should be treated as if they were of the primary variety and the same precautions employed to prevent the lighting up of a primary focus in the lungs or elsewhere, as if such lesion were known to exist.

The Röntgen rays, either alone or following operation, have apparently produced excellent results in some cases and, on account of the danger of local recurrence, may be employed routinely following excision, especially if the operation has been performed for a primary lesion. Radium has been employed by some authorities, with favorable results. The question of anesthesia in tuberculous patients will be considered more fully in a subsequent chapter. Strauss⁴⁰ employs preparations of copper locally in cases of skin tuberculosis. He believes that they not only possess a caustic action, but that they exercise a specific effect on the tubercle bacilli. He recommends the new copper compounds, especially in combination of lecithin and copper, and also methylene blue.

GENERAL.—As in all forms of genital tuberculosis, whether primary or secondary, but especially in the latter, it is of the utmost importance that thorough, systematic treatment be directed towards the improvement of the general health. It is imperative that the reactive powers of the patient be strengthened as much as possible. General hygienic measures, such as regular life, outdoor living, forced feeding, particularly eggs and milk, regulation of the bowels, and perhaps the exhibition of a tonic, should be employed. If the case is a secondary one, this is especially important, and appropriate treatment should be directed toward the primary lesion. The danger of infection should be avoided as much as possible and all predisposing inflammatory causes treated energetically. Patal¹⁴ states that in some cases vaccine exerts a beneficial influence. For a full discussion of the postoperative case, the reader is referred to a subsequent chapter.

The following is a list of cases of tuberculosis of the external genitalia. As many of these cases are associated with vaginal tuberculosis, the list of cases of tuberculosis of the latter region should also be consulted.

CASE HISTORIES

Petit and Bender.^{35, 41} Tuberculous Hypertrophy, Non-Ulcerative, of the Vulva. Patient, aged thirty-one years and single, had a miscarriage eight years before admission for treatment, and later a seven months child that died. Two months ago the patient was delivered of a child, with forceps. During pregnancy she had menstruated as usual. The vulva became uniformly enlarged during the first gestation. The enlargement was progressive but somewhat subsided, following the puerperium. The patient first noticed the vegetations during the third pregnancy. The labia majora became enlarged but did not change in color and seemed to be the seat of an edema. The labia minora, the hood of the clitoris, and the outlet of the meatus appeared transformed into a vegetating tissue of dull red color, and of firm consistency. At the site of the carunculae were four warty tumors that fused together and that partially masked the entrance of the vagina and the urethra. Polypoid hypertrophy of the ureteral mucosa was also present. The lower part of the right labium minus was covered with large verrucosities, as with millet or lentil seeds. No ulcerations whatsoever were present. No pain or functional signs, except frequent and involuntary micturition, were observed. Internal pelvic examination proved negative, as were the lungs. Excision and recovery. Histologic and bacteriologic confirmation of the diagnosis was obtained.

Bender and Nandrot.¹⁶ Woman, aged thirty-nine years, had cervical adenitis in childhood. Two years ago the patient sustained a fall from a horse, after which a cystic tumor gradually formed on the vulva. Nearly a year after the fall the cyst broke spontaneously. The contents were found to be sanguineous, but no pus was present in the early stages. The lesion was extremely chronic, discharged profusely, and after six months the discharge became purulent. At the same time sharp, lancinating pains occurred in the vulvar region. Menstruation became irregular, the patient lost general strength, and became emaciated. Both labia majora were much hypertrophied. A hard, reddish purple enlargement, the size of a nut, was found at the lower, left labium majus. This had two small, fistulous openings, which discharged yellowish green pus. A similar formation existed on the lower part of the right labium majus. A small piece of tissue was excised and a diagnosis of tuberculosis made. Fungous masses were found on the inner surface of the lesion and were removed. A sound introduced into the wound came out in the vagina about 2 cm. above the vaginal orifice. The histological examination showed that the epithelium was hypertrophied and very voluminous. The skin was thickened, edematous, and contained collections of leukocytes under the epithelium and around the vessels. At the site of the ulceration, the epithelial layer was suddenly interrupted, forming a dome shaped depression partly filled by leukocytes and fibrin. The base of this ulceration was formed by granulation tissue and typical tubercles with giant cells were present. Tubercle bacilli were also demonstrated. The leukocytes were mostly polynuclear; plasma cells and mast cells were also observed. Both labia were affected, being considerably thickened (2 or 3 cm.). The surface was irregular and the skin drawn up into numerous, minute, wrinkled folds. A small nodule, about 2 cm. in diameter, was found on the right labium. An analogous formation, but somewhat more massive, was found on the left labium. The hood of the clitoris was thickened and indurated, and the mucosa about the urethra was somewhat discolored. The clitoris itself was not involved. Histological examination showed the skin intact, although thinned in places and thickened in others. The lower layers of skin and subjacent tissue were made up of cellular tissue with numerous blood vessels and large lymphatic vessels. This tissue was abundantly infiltrated with leukocytes, a layer of which involved the stratum immediately subjacent to the epithelium. Beneath the skin and in the subcutaneous tissue, the leukocytes were arranged in the form of perivascular accumulations. The polymorphonuclear elements were in the majority, but there were also numerous plasma cells and mast cells. Tubercles with tuberculous giant cells were present, some

being in the superficial, cellular tissue and some in the deeper layers. Typical bacilli were demonstrated in the tubercles. Sections, stained for elastic tissue by the orcein method, showed that this had been dissociated by connective tissue.

Lecène.⁴² Tuberculosis of Bartholin's Gland. Case 1. Patient, aged forty years, previously had an hysterectomy performed for cancer of the cervix. The author believes that the tumor may really have been tuberculous and mistaken for cancer. Eighteen months afterwards the patient consulted the surgeon, who had performed the operation, for the relief of a small, hard tumor on the labium majus. This was extirpated and, on histological examination, showed tuberculosis of the gland. The secreting acini and excretory ducts were normal. There was a peri-acinal and interlobular inflammation separating the acini. The interacinal tissue was well supplied with blood vessels. Tuberculous follicles with giant cells and tubercle bacilli were found at the edges of the glands. Especially evident was the peri-acinal and perilobular distribution of the lesion, a distribution that would seem to point to a blood infection, and not an infection through the excretory duct.

Case 2. Woman, aged twenty-three years, had bilateral inguinal adenitis, which was painful and in the subacute stage. It appeared first on the right, then on the left. A glandular swelling, the size of a hen's egg, was found in the right groin. It was reddish purple in color and hard, with areas of softening. In the left groin was a mass the size of a pigeon's egg, non-adherent, movable on the subjacent tissues, and slightly painful. There was a fistula external to the sphincter, about five centimeters from the anus, in the middle line, posteriorly. The labium minus on the right presented an ulceration at the union of its inferior third and its superior two thirds. The ulceration was the size of a franc piece and was parallel to the course of the lip. The base was not indurated and the ulcer not secreting freely. At the seat of Bartholin's gland was a swelling the size of a small nut. Examination of the secretion from the base of the ulcer showed tubercle bacilli. The glands, ulcer, etc., were extirpated. Microscopic examination of the glands showed, in places, a peri-acinal lymphocytic and perifollicular lymphocytic infiltration, also giant cells. Bartholin's gland presented the picture of a hematogenous infection.

Nogues.⁴³ Girl, fourteen years of age. Father died of suppurating inguinal fistulas. Some of her sisters died of bronchitis. At two years of age she had meningitis, which left her with suppurating ears, almost complete deafness, and nocturnal enuresis. For the first time, eight months before consulting a surgeon, the patient was found to have

straining at micturition and increase of urination, with almost persistent nocturnal incontinence. Gonococci were found in the vulvar discharge. There was a tuberculous involvement of the labia. Attempts to demonstrate tubercle bacilli by staining methods failed. The diagnosis was however verified by animal inoculation.

Renaud.²⁹ Tuberculous Ulcer of the Labium Majus—Primary. Child, aged four years, presented a reddish blue discoloration and a fluctuant swelling of the left labium majus. Palpation was not very painful. An ulcer, found in the superior part of the lip, lays bare the canal of Nuck and the round ligament. The edges of the ulceration are infiltrated, clear cut, and reddish purple in color. The base is grayish yellow and covered with a sanious secretion. This ulceration meets the lesser lip and in the interlabial sulcus are two whitish yellow areas resembling grains of sago. The glands of the groin are small, hard, and indurated. Examination of the secretion showed tubercle bacilli and colon bacilli. The ulcer was treated with tincture of iodine and a dressing of iodoform was applied. The ulcer healed, after the disappearance of the tubercle bacilli, and the child's health remained good. There had been no tuberculosis in the family, and the child was not otherwise affected with this disease. The case began as an erythema of the affected parts.

Dambrin and Clermont.²⁶ Patient, aged eighty-eight years. Nothing bearing on the subject of tuberculosis was found in the personal history, except a pneumonia at the age of forty-five years. She consulted a physician for an enlargement of the vulva, which had been present for about eight months. There was no pain, except for occasional lancinating pains in the tumor. The tumor in the right labium majus was egg shaped, smooth, and regular, a little painful to pressure, and non-adherent to the skin or deeper layers. It did not seem to be attached by a pedicle, and appeared to be totally contained in the labium majus. The uterus was small and the other genital organs were normal. An incision into the tumor while attempting its removal showed it to contain grumous pus. It was a cold abscess secondary to a bone disease of the anterior surface of the os pubis. The case was remarkable because of its rarity, the difficulties of diagnosis, the age of the woman, and because the abscess did not open spontaneously.

Wolff.⁴⁴ Patient, aged fifty-one years, had an ulcer on the left labium majus one half year before examination. A clinical diagnosis was impossible, but tuberculosis was recognized microscopically. The patient had formerly had a tuberculous tenosynovitis of the right hand and also pulmonary tuberculosis with bacilli in the sputum. The vaginal introitus was unaffected.

Legane.³² Girl, six years of age, with tuberculous family history. She had incontinence of urine and the entire vulvar region, including the hymen, was occupied by a yellowish ulceration. The urethral orifice was completely destroyed by the ulceration. The kidneys were not painful nor palpable. Tubercle bacilli were found in the urine. The child died of pulmonary tuberculosis. At autopsy one kidney and bladder were found to be tuberculous.

Winter.⁴⁵ This patient had an ulcer with a lardaceous base on the interior surface of the labia minora. The adjacent mucous membrane was red and infiltrated. A rectal fistula was also present. On histological examination tuberculosis and tubercle bacilli were found.

Schenk.¹⁸ Girl, four and a half years of age, had a large ulcer of the vaginal orifice which involved the labia minora, the clitoris and the urinary meatus. Considerable edema and hypertrophy were present. An inguinal adenitis was present. The child had two tuberculous playmates and Schenk believes that the infection occurred from their fingers. The family history was negative for tuberculosis. Histological examination of the ulcer and of the glands showed tubercle bacilli in both.

Küttner.⁴⁶ Girl, four and a half years of age, with whooping cough. No tubercle bacilli were found in the sputum. There was hard induration of the right labium majus, with ulcerative involvement of the upper two thirds. Smaller ulcerations were present on mons veneris and the upper part of the left labium majus. Biopsy and diagnosis of tuberculosis. The ulcer and enlarged inguinal glands were excised. Histological examination of the ulcer and of the inguinal glands showed the lesions to be tuberculous. Child in good health three months after the operations.

Gebbard.⁴⁷ The patient had a small, ulcerated, soft tumor the size of a cherry seed, on the vulva. A small ulcer developed and involved the external urinary meatus. The tumor was about as hard as a wart. The outgrowth showed the histological characteristics of tuberculosis.

Martin.^{30, 48} Case 1. This was one of typical tuberculous ulceration of the labia minora. The diagnosis was made by histologic examination. Patient, aged twenty-three years of age, presented a tumor of the vulva. She had vaginitis at fourteen years of age, after which the left labium minus began to swell and become red, hard and painless. The patient began to lose weight. Phthisis was present at the apex of the left lung. An ulcer was found in the sulcus between the left labia minus and majus, which bled easily. The hood of the clitoris was hypertrophied and another small ulcer was present between the right labia majus and minus. The entire vulva was edematous. There were small tumors, about the

size of nuts, on the raphé and around the anus. These latter somewhat resembled hemorrhoids. A rectovaginal fistula and adenitis of the right inguinal glands were present. At autopsy the tumor resembled elephantiasis. Tubercles and tubercle bacilli were found in the vulva. The author believes that this is the first case of this kind in which tubercle bacilli have been demonstrated.

Case 2. The patient was thirty-two years of age. Both right labia were involved, especially the labium majus. A reddish tumor-like outgrowth, the size of an apple, was present. The surface was wrinkled and wart-like, especially the inner aspect. The left labium was also enlarged. The condition caused considerable pain and much itching. The vagina was involved and the inguinal glands enlarged. Excision was practiced and histologic verification of the diagnosis was obtained. Recovery.

Montgomery.²⁰ Patient, aged thirty years. Colored. Married. She had a negative family history, but tuberculosis was present in the husband's family. The menstruation was regular, had four children and one miscarriage. The genital symptoms began ten years ago. Both labia became enlarged, especially the right. On the inner surface of the vulva was an ulcer, one fourth inch deep and one third inch wide, which extended from the posterior surface of the vagina forward to the external genitalia. Considerable edema was present. This and part of both labia were excised, and the histologic examination showed them to be tuberculous.

Chiari.⁴⁹ Woman of thirty years had phthisis, of which she died. At autopsy, general tuberculosis was found. The lungs were extensively involved and there were ulcers in the rectum. The tubes, ovaries, and uterus were normal. There was edema of the labium majus and of the vulvar region. A large ulcer was present on the right labium majus, extending to the labium minus and to the skin, clitoris and meatus. The anus also presented an ulcer. The specimen showed the typical histological picture of tuberculosis, and the specific organisms were demonstrated.

Viatte.³⁷ The patient was a woman thirty-two years of age. For seven years she had a yellowish purulent leukorrhea, varying somewhat in amount. For the last three years small polypoid growths had appeared on the vulva and in the neighborhood of the external urinary meatus. Occasionally these fell off and new ones appeared in their place. Upon removal of the tumor it was found to cover an ulcer which extended into the vagina. The ulcer had a firm base and a yellowish surface. Histologically, this did not present a typical tuberculosis, but scrapings from

the ulcer showed tubercle bacilli. The tuberculin test was positive. No phthisis was present.

Deschamps.⁷ The patient was a woman of twenty-five years of age in the last stage of phthisis. She had a fall and injured her vulva, which was followed by swelling. Four months later a deep ulcer developed, which, at the time of examination, occupied the left labium majus and extended backwards as far as the fourchette. The chief symptom produced by the genital condition was itching, which was marked. A moderate amount of discharge and slight bleeding, if traumatized, was also present. No adenitis was observed. The lesion was excised and its tuberculous character proven by histologic examination and animal inoculation. A tuberculous ulceration was also present on the dorsum of the hand. At her death the peritoneum and internal genital organs were found normal.

Demme.²⁵ A child of thirteen months had an ulcer of the left labium minus. Tubercle bacilli were demonstrated in the secretion from the ulcer. The patient died at sixteen months of age of tuberculous meningitis. The child's mother had pulmonary tuberculosis. Autopsy showed the labial lesions to be tuberculous. An ulcer of similar etiology was also found in the vagina. The ulcers were irregular, granular and reddish.

The author believes this case to have been one of primary genital tuberculosis, as the genital lesions appear to have antedated the meningitic involvement by some months.

Rieck.¹⁹ The patient's family history was negative for tuberculosis. Before marriage the patient presented no evidences of tuberculosis. The husband died of tuberculosis. Some time after marriage the external genitalia showed evidences of disease. The right labium majus was the seat of an acute tuberculous inflammation, and on the left labium minus was a stellate ulceration, involving the introitus on the left side, and the labium minus was elongated, hypertrophied and perforated by ulcers with sharply cut, raised edges in two places. It was somewhat condylomatous in appearance. The growth of the ulcer was slow, but progressive. The elephantiasic change had preceded the ulceration by some months. The lesions were excised, and tubercle bacilli were demonstrated in the tissue histologically.

Kelly.⁵⁰ Woman, aged fifty-five years, had a small, triangular shaped, eaten out ulceration at the anterior commissure, which had been present for one year. On urinating, the patient had pain on the ulcerated surfaces. The subjacent tissue was remarkably indurated and the clitoris red and swollen. On histological examination tuberculous

lesions with bacilli were demonstrated. Diagnosis, tuberculosis of the clitoris and vestibule.

Rechenbach.⁵¹ The patient had dysmenorrhea and dyspareunia. The heart and lungs were normal. The labia minora were hypertrophied and elephantoid. A small, edematous tumor was present on the clitoris. In front of the urethral orifice was an ulcer, the size of a five franc piece, covered with soft, fungous, easily bleeding granulations. The uterus was small and anteflexed, and the pelvic organs were otherwise normal. The growth was excised. Recovery. On histological examination leukocytic infiltration and giant cells were observed and showed the usual microscopic picture of tuberculosis.

Boursier.⁵² Case 1. Woman, aged sixty-three years, who was pale, thin, and cachetic looking. She first noticed an enlargement of the right labium majus one year previous to examination. This gradually increased in size and finally measured 15x12 cm. and 5 or 6 cm. in thickness. The skin over the tumor was thickened, hypertrophied, and presented the appearance of an elephantiasis. It was hard and elastic in consistency. A diagnosis of elephantiasis was made. The tumor was extirpated and the wound healed by first intention. Histological examination showed the lesion to be tuberculous. No tubercle bacilli were sought for. A year later a similar tumor with slight superficial excoriations appeared on the left labium majus. A little later the woman had an attack of erysipelas. This was followed by a second attack, which was complicated by pelvic abscesses, one of them pointing in the region of the anus, the other in the vagina. These were incised and the anal and perineal regions at this time presented an elephantoid appearance. Signs of tuberculosis also developed.

The inguinal glands were palpable. The left labium minus became hypertrophied and indurated. The vagina was normal. The cervix showed fungoid masses, a curetted piece of which, when examined microscopically, presented evidence of tuberculosis. The tumor subsequently became ulcerated.

Case 2. Patient, twenty years of age. The case was one of simple hypertrophy, the vulva being enlarged to three times its normal size. The left labium minus was hypertrophied and wrinkled. The region of the clitoris and both labia majora were also thickened and edematous, but no ulcerations were present. The condition resembled an elephantiasis. The apex of the right lung was suggestive of tuberculosis. The patient had pleurisy three years ago. The tumors were excised and no recurrence was noted. On histological examination the specimens proved to be tuberculous. The pulmonary lesions progressed, and although a

fatal termination was not noted, an unfavorable prognosis was given on this account.

Case 3. Patient, aged twenty-six years, had pulmonary tuberculosis. She had ulceration of the middle part of the free border of the left labium minus, which was excised. Histological examination showed tuberculosis with giant cells.

Karajan.⁵⁴ Primary Tuberculosis of the Vulva with Elephantiasis of the Clitoris. Child, 2 years of age, whose hands were frequently on the genitals. Family history negative. There had been a swelling and itching of the genitalia for one year. No fever, cough, or diarrhea or signs of visceral tuberculosis were present. On separation of the swollen labia majora, a penis shaped tumor was revealed, which measured 3x1.5 cm., with small areas of loss of tissue substance, each area about the size of a pin's head. This tumor represented the clitoris, the distal extremity of which was covered by an eczematous prepuce. The surrounding skin was red, excoriated, and covered with crusts. Examination and voiding of urine caused pain. The inner genitalia were normal. The diagnosis of elephantiasis of the clitoris was made. The tumor was excised and ten months afterward the patient returned, her father stating that the wound had healed, but recently a new ulcer had appeared. At this time there was an inguinal adenitis. Gradually a tumor, one centimeter in length, developed at the site of the original operation. The ulcer was situated on the right side, involving the vulva and vagina. Histological examination showed both tumors to be composed of connective tissue, partially covered by normal skin, in which tubercles were irregularly distributed below the derma. These were characteristic of tuberculosis. The severe pain on urination persisted. No tubercle bacilli were demonstrated in the discharge from the tumor. One year after the operation an ulcer was present on the wall at the entrance of the vagina.

Jesionek.⁵⁵ Woman, 75 years old, was admitted to the clinic with a diagnosis of carcinoma vulvae. She had previously suffered a fracture of the neck of the femur. The lungs were negative, although there was a tuberculous family history. A dark red, prominent tumor, with an irregular surface, was present at the urethral outlet, which bled easily on touch. The tumor was removed. Microscopic examination of the subepithelial tissue presented accumulation of lymphoid cells, granulation tissue, and giant cells. The author believed this to be tuberculosis.

Demme.²⁵ Case 1. Woman, 64 years of age. For one and one half years she had hematuria, which gradually became associated with pain. There were polypoid vegetations of the urethra, which, when excised

and examined histologically, showed typical giant cells. The process was localized to the superficial layers of the mucosa.

Case 2. In a woman, aged 33 years, the urethra was involved by tuberculous, polypoid vegetations, and the greater and lesser labia were the seat of a slight elephantiasis, without, however, specific tuberculous findings on histological examination.

Case 3. Woman, 23 years of age, had indolent tumefaction of right labium majus with ulceration. A right sided inguinal adenitis was present. Abdominal pain, swelling, meteorism, diarrhea, pallor and other evidence of intraperitoneal involvement became manifest. Finally both labia majora were involved. The introitus vulvae was ulcerated and the inguinal glands enlarged bilaterally. The vulva probably became infected by contact with the intestinal discharges.

In 1851, Geil⁵ reported three cases of vaginal tuberculosis which accompanied uterine lesions. These three cases were the only ones occurring among forty-five cases of uterine tuberculosis.

Purslow⁵⁶ reports a case of tuberculous elephantiasis of the vulva in a woman 37 years old. Both labia were affected, swollen, and the surface covered with small, round depressions with intervening elevations, and more or less coated with thin serum. The surface was not reddened. The patient also suffered from what was clinically diagnosed as tuberculous pelvic peritonitis, for which an abdominal section was performed. The vulva swelling was excised. No pulmonary tuberculosis was present. Although the case is reported as one of tuberculous elephantiasis of the vulva, no proof is brought forward to show that this type of infection was present, nor was syphilis excluded. A doubtful case.

Hartmann.⁵⁷ Woman, aged 27 years, with well marked family history of tuberculosis. She had tuberculous hypertrophy of the external urinary meatus and stricture of the urethra. Had pains and frequency of micturition for six years, unimproved by various treatments. Examination showed, in the region of the urethral orifice, a gray crater-like ulcer with expanded, thickened edges. Two cm. within the urethra a well marked stricture was found. The urethra was freed as far as the upper limits of the structure and excised. The operation was successful. Histologic examination showed the tissue to be the seat of a well marked tuberculosis. The urethral walls were thickened, especially the submucous coat, and in this situation numerous tubercles were present. Tubercle bacilli could not be demonstrated, but animal tests were positive for tuberculosis.

Davidsohn's²⁸ case concerned a woman who had an excessively hard

labor. Two days later an acute miliary tuberculosis developed and proved fatal in three weeks. At autopsy, the entire vagina, as well as the labia minora, were found thickly studded with recently formed miliary tubercles. The cervix and urinary passages were not involved. The diagnosis was confirmed by both histologic and bacteriologic proof.

Cayla.² The patient died of an extensive pulmonary tuberculosis. Autopsy showed that the vulva, especially the labia majora, was swollen, indurated, and the seat of a number of ulcers. Nodules were also present. The ulcers were chiefly in the internal aspect of the labia majora. The ulceration also involved the vagina and skin perineum as far as the anus, and in the former were extensive. A few vegetative outgrowths were present. The uterus was normal. Histologic verification of the diagnosis.

Deuse⁵⁸ reports three cases of genital tuberculosis in children.

Case 1. A child 13 months old. The ulcer was situated upon the inner aspect of the labium minus. In the discharge from the ulcer numerous tubercle bacilli were found. Death occurred when sixteen months of age from tuberculous meningitis, at which time, in addition to the ulcer of the vulva, one was found in the vagina. This also contained tubercle bacilli.

Case 2. A child 7 months of age. The father was tuberculous. The ulcer was situated at the orifice of the vagina.

Case 3. A child 15 months of age, with a good family history. A mucopurulent leukorrhea appeared after an attack of measles. The ulcer was situated at the orifice of the vagina and its tuberculous nature was proven by histologic examination. Tubercle bacilli were also demonstrated in the iliac gland. The child died from a tuberculous pneumonia.

Stealy.⁵⁹ Patient had a family history of tuberculosis. Had septicemia three months ago. When first observed the temperature was 99°-100° F. Pulse 100-120. The patient fell astride a hard object, causing a laceration of the vestibule, in the region of the external urinary meatus. The edges were undermined, the base was the color of apple jelly and contained about ten macroscopic tubercles. The curettings of the ulcer contained tubercle bacilli, as proven by staining and animal inoculation. Following the anesthetic, pulmonary phthisis developed. The lungs were thought to have been normal prior to the operation.

Daniel⁶⁰ describes a case of tuberculosis of the vulva, in which the labia and preputium clitoridis are hypertrophied and the inguinal glands enlarged. The Wassermann reaction was negative, the ophthalmic reaction positive, and antiluetic treatment had no effect on the disease. The woman was 36 years of age and had had three miscarriages. Daniel

believes that the disease was transmitted from the husband by coitus and that the disease was primary in the vulva. The husband had syphilis and a tuberculous lesion at the apex of one lung. Extirpation of the diseased parts and of the inguinal glands resulted in cure. This is a case of non-ulcerating tuberculosis of the hypertrophic variety. The diagnosis of tuberculosis was verified by histologic examination.

Meriel⁵² reports two cases of tuberculosis of the vulva.

Case 1. This was of the hypertrophic form, a tumor which arose from the labium minus, covered the vulva, and had the appearance of elephantiasis. The neighborhood of the clitoris, the posterior commissure, and the labia majora was thickened and condylomatous. The mucosa was not thickened, nor were there any ulcerations. At the apex of the right lung tuberculosis seemed to be threatened. The hypertrophic portions of vulva were excised and, upon microscopic examination, proved to be tuberculous. Several years later no local recurrence had occurred although the lung condition had advanced.

Case 2. The second case was the more common ulcerative form of vulvar tuberculosis and in it also the lungs were involved. Meriel believes that the disease may be propagated, not only through the circulation, but also by direct infection.

Kromer⁶¹ in reporting some rare cases of tuberculosis of the female genitalia, briefly mentions two cases, one of elephantiasis of the vulva, which had its origin from a tuberculous skin lesion, and the other an ulcerative lesion at the mucocutaneous junction.

Zweigbaum.⁶² The case was one of secondary infection from the vagina. The patient died of pulmonary tuberculosis and at autopsy the uterus, tubes and ovaries were found normal. The vagina and external genitalia were the seat of ulcerative lesions which upon histologic examination presented the characteristic picture of tuberculosis.

Author's case. Ulcerative tuberculosis of the external genitalia, secondary to hip joint disease. Patient, aged 22 years, and single. For seven years she had been a sufferer from a slow, progressive, tuberculous hip joint disease, which neither operation nor careful general treatment seemed to affect. When seen by the author, both labia majus and minus were swollen and edematous. This condition was most marked on the left, where the lesser labium was enlarged to six times its normal size. It was slightly reddened and a few engorged vessels were present on its surface. The enlargement on both sides was apparently due, not so much to an hypertrophy or inflammation, as to an edema. On the outer surface of the labium minus and the inner and adjacent surface of the labium majus on the left side was a fairly deep ulceration about 8x4x1.5

cm. The base was grayish and covered with a thick, tenacious, purulent discharge. The edges near the deepest portion of the ulcer were ragged and undermined, while in the shallow portion of the ulcer they were fairly smooth. The edges and base of the lesion were hard, and the former more or less elevated. The ulcer was essentially chronic in appearance and even viewed alone did not particularly suggest either a malignant or venereal origin. The labium minus was chiefly affected, and the lesion on the majus was probably the result of either an extension by continuity or a contact infection, which was impossible to determine owing to the advanced stage. Two smaller but similar ulcers were present on the skin perineum, one near its center and the other closely approaching the anus. The entire skin, perineum, and adjacent surface was the seat of a dermatitis. The vagina, uterus, and appendages were normal. The left hip joint was the seat of an extensive tuberculosis, and the entire skin, perineum, and adjacent region were honeycombed with sinuses which were discharging profusely. None of these sinuses actually involved, by continuity, the genital lesion above mentioned. A small piece of the ulcer of the labia was excised, and histologic examination showed the typical picture of tuberculosis, numerous giant cells and tubercles being present. A few tubercle bacilli were also demonstrated. In this case the genital condition was clearly secondary to the hip joint disease, which had antedated it for over six and a half years, and probably had resulted from the constant drenching of the skin surface with tubercle bacilli bearing discharges. The patient was referred to a general surgeon and died nine months later, up to which time the ulcer on the external genitalia and adjacent structure had enlarged but little.

Winckel.¹ Case 1. The patient was 28 years of age and gave a negative family and previous history of tuberculosis. Springing from the labium minus was a firm, reddish, rounded, tumor-like outgrowth the size of a pigeon's egg. On the inner aspect of the mass was a superficial granular ulcer 1 cm. in diameter. The labium majus and clitoris were enlarged, as well as opposite labium majus. Considerable edema was present. The tumor was excised and the diagnosis verified by histologic examination.

Case 2. The patient was 26 years of age and gave a negative previous history of tuberculosis. The region of the vulva was hardened, swollen, and the base edematous, the labia minora and clitoris were also indurated. Between the labia was an ulcer which discharged purulent material. The diagnosis was verified by histologic examination.

Pöverlein.³⁶ The patient was a multipara, married and 49 years of age. The family history was negative for tuberculosis. Trauma appears

to have been a predisposing factor in the production of the genital lesion. The genital lesion had been present for a long time and growing slowly. There was dysuria and pain on defecation. From its size the lesion also caused discomfort. When examined, a number of tumor-like masses were found which practically obliterated the vulvar orifice. These sprang from the right labia majus and minus. The tumor-like masses were wart-like in appearance, wrinkled, pigmented, and the outer surface was covered with coarse hair. A diagnosis of sarcoma of the labia majus and minus was made. Excision was performed and the correct character of the lesion determined by histologic examination.

Hamburger.⁶³ A child 3 years of age presented an ulcer on the inner surface of the labium minus. The ulcer was irregular in outline, the edges were rough and the surface covered with purulent discharge. Tubercle bacilli were demonstrated in the lesion. Hamburger believes the case a primary one.

Bender.¹³ The patient was 39 years of age. Both labia minora were transformed into tumor-like masses two or three centimeters in diameter. The labia majora were also involved. The surface of the lesions was irregular, wrinkled and like the skin of an orange, and was reddish purple in color. On the superior aspect of the right labium minus was a small dark colored nodule. The clitoris and surrounding skin were swollen and indurated. An excision was performed and the diagnosis verified by histologic examination.

Logothetopoulos.⁶⁴ A woman of advanced age presented herself, suffering from symptoms which had led to the diagnosis of cancer of the vulva. The menopause had been established for some time. Examination showed a fairly large reddish tumor, the surface of which was roughened and irregular. It was painful when pressed upon and bled easily when slightly traumatized. The uterus and adnexa were normal. The tumor was excised and the diagnosis verified by histologic examination. The patient died six months after the operation and autopsy showed tuberculosis of the right lung.

Legane.³² The patient was a child who suffered from tuberculosis of the kidney and secondary involvement of the bladder. The vulva and region of the hymen were the seat of an irregular ulcer, which caused pain on movement and following urination. Considerable discharge was present. Legane mentions the possibility of this being an implantation lesion from tubercle bacilli in the urine, as the kidney lesion had antedated the ulcer on the genitalia. Histologic verification of the diagnosis.

Forgue and Massabeau.⁶⁵ Secondary hypertrophic tuberculosis

of the vulva. The patient was a woman 25 years of age, who, fifteen years prior to the onset of the genital symptoms, had had a tuberculous adenitis. This had been cured by surgical measures. Examination showed pulmonary tuberculosis. For some time there had been profuse purulent, and at times blood streaked leukorrhea. A year or more ago an enlargement of the middle of the right labium majus was noticed. This continued to grow and, when observed, was of the size and somewhat the shape of an adult scrotum, it was fairly firm to the touch, partially covered with hair, the skin was somewhat wrinkled and discolored, the base and opposite labium were distinctly edematous. Springing from the lower side of the elephantiasis-like mass, and tending to become pedunculated, was a polypoid or vegetation-like tumor; this was markedly papillary in character, and was the size of a small nut. The skin on the inner surface of both labia majora was moistened and somewhat macerated. The inguinal glands were enlarged and suppurating. There was edema of the right leg. Excision of the diseased area and of the enlarged glands was performed and the diagnosis verified by histologic examination. Nine months later the patient returned to the hospital. There was marked tumefaction at the site of former operation and the opposite labium was also affected. The right leg was extremely edematous. The patient died in a short time from pulmonary tuberculosis. Autopsy.

Brault.³³ The patient was a child 7 years of age, in whom pulmonary tuberculosis was present. There were fever and albumen. About one year previously an ulcer had appeared upon the labia minora and clitoris. This spread rather rapidly and, when seen, occupied both labia majora and minora, the clitoris, and extended backwards over the perineum half way to the anus and inwards into the vagina. The ulcer was dark reddish in color and soft and friable to the touch. Here and there yellowish areas were present. The inguinal glands were enlarged. Peritonitis developed, from which the patient died. Autopsy and histologic and inoculation verification of the diagnosis was obtained.

Krömer.⁶⁶ A large ulceration was present in the vulvar region, the clitoris had been destroyed, and there was involvement of the external urinary meatus and labia minora. The ulcer possessed an irregular outline, somewhat undermined and swollen edges, and a granular base, more or less covered with thick purulent discharge. Biopsy was performed and revealed the true character of the lesion. Radiotherapy produced some amelioration of the condition. Finally, however, the diseased area was excised. Recovery.

Schuchardt.⁶⁷ The patient was a girl who for some time had had a

cough. Loss of weight, night sweats, and other signs of pulmonary tuberculosis were present. A physical examination showed the usual evidences of phthisis. Tubercle bacilli were also recovered from the sputum. Some time previously, a small ulcer had appeared on the lower portion of the labium majus. This had enlarged slowly but progressively and another ulcer formed at the introitus. These were chronic looking shallow ulcers, with slightly elevated and indurated edges. A moderate amount of discharge was present. Excision and histologic verification of the diagnosis.

Clark⁶⁸ mentions two cases of tuberculosis of the vulva, both of which were secondary. No detailed report is given.

Kelly.⁵⁰ The patient was a widow 35 years of age. A small ulcer appeared in the region of the clitoris one year before patient came under observation. Ulcer increased in size gradually. It presented a reddened, eaten out appearance. The chief symptom was a stinging pain at urination. Ulcer was excised and tubercle bacilli demonstrated in small numbers in the specimen.

Bulkley.³ Patient aged 42. One child and one miscarriage. Lesion appeared as small raw area on inner surface of labia minora and progressed for five years. Dyspareunia and occasional burning pain the only subjective symptoms. No evidence of primary focus of tuberculosis other than that in the genital tract. When observed left labium was the seat of a dumbbell shaped, partially undermined ulcer. No hypertrophy and but little induration. Base of ulcer was grayish and did not bleed easily, but was more or less covered by mucus and pus. Excision. One month later small recurrence in form of an ulcer. This was treated locally, and four months from original operation was cauterized with the Paquelin cautery. Diagnosis confirmed by histologic examination. No tubercle bacilli demonstrated. Death six months after operation with signs of acute miliary tuberculosis.

MacDonald.⁶⁹ Case 1. A multipara aged 40. No other tuberculosis focus described. Death after two and one half years. At time of death there was a lupus-like lesion involving entire vulva and perineum. The surface was ulcerative.

Case 2. A primipara gave a history of a fall upon the vulva two years prior. The lesion was hypertrophic and ulcerative. One year after curettage and cauterization there was no return.

Defontaine.⁷⁰ The patient, aged 40, gave a history of pulmonary tuberculosis. A lesion of the wrist and a rectovaginal fistula were also present. The labium majus was the seat of a tuberculous fistula, which was cauterized and healed in six months.

Weinlechner.⁷¹ A multipara 38 years of age. No other tuberculous focus. Occupying the labia on each side was a large ulcer, which was treated by cauterization. Recurrence in one and one half years. The tuberculous ulcer developed upon a syphilitic lesion.

Häberlin.⁷² A tripara 27 years of age. No other focus of tuberculosis reported. The entire introitus, including both labia majus and minus, clitoris and adjacent parts, was the seat of a hypertrophic ulcer. Treated by excision. Result not stated.

Hintze.⁷³ A tripara presented a large tuberculous ulcer involving the mons, both labia, and the perineum. This was excised. Result not stated. No other tuberculous focus found. Possibly a primary case.

Brosin.⁷⁴ The specimen was a pathologic one and but few data given. The patient was an aged woman. There was a tuberculous ulcer on the vulva.

Fiocco and Levi.⁷⁵ A hypertrophic ulcer involving the vulva was treated by curettage and cauterization. Rapid healing. End result not stated. Probably a secondary case.

Hansen.⁷⁶ This was an autopsy case of a child 4 years of age, who died of a general tuberculosis. It is thought by Hansen that the infection had been primarily renal. The vulva was the seat of a miliary tuberculosis. The tubes, uterus and vagina were also involved.

Erhmann.⁷⁷ Case 1. The patient was a prostitute, 32 years of age, suffering from pulmonary tuberculosis. Surrounding the external urinary meatus was a tuberculous ulcer. This was treated with iodoform and healed in six months.

Case 2. The patient was 50 years of age and had a tuberculous ulcer on the labium majus and posterior commissure. This was treated as in Case 1. Result not stated.

Case 3. A patient, 56 years of age, who presented no signs of pulmonary tuberculosis, suffered from a hypertrophic ulceration involving the labium majus and fourchette. This was excised. Result not stated.

DePaoli.⁷⁸ Case 1. The patient had a tuberculous hypertrophic ulceration involving both labia.

Case 2. This was a similar lesion involving similar parts. In this patient the genital lesion was secondary to a tuberculous peritonitis.

Chiarabba.⁷⁹ This patient had a hypertrophic ulceration involving the labia majus and minus, evidently secondary to a tuberculosis of the peritoneum, fallopian tubes, uterus, and cervix.

Audry and Combléran.⁸⁰ Patient, aged 26, had a tuberculous ulcerative lesion involving the right labium minus. Tuberculous inguinal adenitis was also present. The ulcer was treated by excision.

Frattali.⁸¹ The patient was 19 years of age and had a tuberculous ulcer involving the labia majora and vagina. Tuberculous inguinal adenitis was also present.

Daniel and Jianu.⁸² Case 1. A multipara, aged 45 years, presented an hypertrophic ulceration of both labia minora and clitoris. This was treated by excision and healed. The final result not stated. This patient also suffered from tuberculosis of the rectum.

Case 2. The patient, aged 45 years, and who exhibited no evidence of tuberculosis elsewhere in the body, showed a hypertrophic ulceration of the labia majora, which was treated by excision. End result not stated.

Krömer.⁸³ A quintipara presented herself, suffering from a tuberculous hypertrophic ulceration of the vulva. This was treated by excision. End result not stated.

Mauler.⁸⁴ Case 1. An autopsy case. Subject aged 37. Postmortem showed tuberculosis of lungs, intestines, spine, uterus, tubes, and vagina. The introitus was the seat of multiple ulcers.

Case 2. Autopsy case. Age 41. Postmortem showed tuberculosis of lungs, joints, kidney, suprarenal, spine, fallopian tubes, uterus, and vagina. Ulcers were also present in the introitus.

Stöckel.⁸⁵ A patient, 28 years of age, suffered from an ulcer on the anterior commissure. This was treated by excision and cauterization. Recovery. End result not stated. Miliary tuberculosis of the intestines was present.

Rossle.⁸⁶ Autopsy case. This was a subject 87 years of age. Tuberculosis of the lungs, uterus, cervix was present. In the anterior commissure was a tuberculous ulcer.

Wichmann⁸⁷ reports a case of extensive ulcerative tuberculous lesion involving the urethra, clitoris, and vulva in a woman 37 years of age. The case was probably a secondary infection and was combined with syphilis.

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CHAPTER VII

TUBERCULOSIS OF THE VAGINA

First authentic case of vaginal tuberculosis recorded—Anatomic relationship existing between external genitalia and vagina—Histologic similarity—Etiology—Varieties—Symptoms—Experimentation tending to show that trauma and irritation are important predisposing factors in implantation form—Ulcerative appearance—Miliary form—Hypertrophic—Characteristics—Syphilis, malignant neoplasms, chancroid, gonorrhea, noma and diphtheria differentiated—Cases cited—Primary tuberculosis of vagina and vulva—Histologic examination—Cases collected by Chaton and others.

In 1831 Raynaud¹ described a case of vaginal tuberculosis which was secondary to a similar infection of the uterus and tubes. In 1883 Babes² reported the history of a case of a tuberculous ulcer in the rectum, which had perforated into the vagina and resulted in a tuberculous vaginitis, in the discharge from which tubercle bacilli were demonstrated. This is the first authentic case of vaginal tuberculosis recorded.

Owing to the close anatomic relationship which exists between the external genitalia and vagina and the histologic similarity of these two areas, tuberculosis of the vagina in many respects resembles that of the external genitalia. Indeed, not infrequently vulvovaginal lesions are observed, the condition in these cases usually originating in the vagina, and from thence spreading by direct extension to the external genitalia, although occasionally the converse is true.

With the exception of lesions of the external genitalia, infection of the vagina is the rarest variety of gynecologic tuberculosis. Among 6,557 gynecological specimens in the gynecological laboratory of pathology at the University of Pennsylvania, but one example of this form of infection has been observed.

Etiology.—Tuberculosis of the vagina may be primary or secondary, the latter being by far the most frequent. Direct implantation may result by means of infected semen, sputum, douche nozzles, fingers, tubercle bacilli bearing discharges from the upper genital tract, or from without. Direct implantation may therefore be either an autogenous or exogenous infection.

The secondary variety may result from an extension from nearby structures, such as the cervix, external genitalia, or intestine, and lastly

a hematogenous or lymphogenic infection may occur. Weigert ²⁰ has described a case of vaginal tuberculosis secondary to a tuberculous peritonitis, in which the upper genital tract was normal. Oppenheim,⁴ in seven cases of tuberculous vaginitis, found the adnexa involved in all, and the uterus was diseased in three.

Tuberculosis of the vagina, resulting from a direct extension by continuity, is relatively frequent. Daurios⁵ observed 24 cases of recto-vaginal or vesicovaginal fistula among 166 cases of genital tuberculosis. Among cases of cervical tuberculosis, the abstracted histories of which can be found in the subsequent chapter, many cases of extensions to the vagina have occurred. Implantation lesions, caused by tubercle bacilli bearing discharges from the upper genital or urinary tract, are by no means uncommon, while hematogenic and lymphogenic, especially in the miliary variety, frequently occur. Pozzi⁶ states that when a patient, in advanced phthisis, develops vaginal lesions, these are not infrequently caused by contamination with tubercle bacilli bearing diarrheal discharges.

Symptoms.—In many respects, these are similar to those produced by lesions of the external genitalia. As the disease is usually secondary, the symptoms produced by the primary focus are often the most pronounced, these naturally varying widely. The symptoms arising from the vaginal condition present nothing pathognomonic. Animal experimentation tends to show that trauma and irritation are important predisposing factors in the implantation form, whether it be of the auto-genous or exogenous variety. In guinea pigs and rabbits it has been found almost impossible to produce vaginal lesions even by the injection of large quantities of a pure culture of tubercle bacilli into the vagina, unless the latter has been previously traumatized or a preëxisting inflammation has been present. Trauma is also a predisposing agent in the hematogenic or lymphogenic infection. Apart from the trauma, the puerperium, by prolonged maceration of the vagina mucosa by the lochia and the hyperemia which exists at this time, appears also to act as a predisposing factor. No period of life is immune. The average age of twelve cases of vaginal tuberculosis was 16.8 years, the extremes being four and a half (Schrenk⁷), 7, 13 and 15 months (Demme⁸) and 39 and 50 years (Demme⁸).

The most constant symptom is discharge. This varies in character and amount, according to the stage and variety of the lesion. In the ulcerative variety it may be blood streaked, and this is especially likely to be the case following trauma. It is usually more or less purulent. In the miliary variety it is generally moderately profuse, thin and irri-

tating. There is often little discharge in the hypertrophic variety and that which is present is moderately thin. As a result of the leukorrhea a vulvovaginal pruritus is frequent and may be the most severe symptom. This is generally the result of the toxins in the discharge and is most frequently observed in children in whom the skin is thin and tender, in women of unclean habits, and in neglected cases. Pain is rarely a marked feature, as one of the characteristics of vaginal and vulvar tuberculosis is its chronicity. Dyspareunia is usually present and dysuria is not infrequent. Inguinal adenitis, especially in the ulcerative variety, and in the late stages of the disease, is common. It is most likely to be present when the lesions are in the outer portions of the vagina. Fever and other systemic disturbances are rarely produced by the vaginal lesions alone, but are often present as a result of tuberculosis in other parts of the body.

Varieties.—Tuberculosis of the vagina may be ulcerative, hypertrophic, or miliary, or combinations of these forms may occur. As in tuberculosis of the external genitalia, the ulcerative variety is the most frequent. In twelve cases, the reports of which have been sufficiently clear to determine the variety, nine were of the ulcerative variety, two of the miliary, and one of the hypertrophic.

ULCERATIVE.—This usually begins with a more or less localized swelling, which softens and finally breaks down. The ulcers may be single or multiple, the latter being the most frequent. The ulcers vary widely in size and frequently coalesce. Contact lesions are not infrequent. In the base of the ulcers and on the surface of the adjacent vaginal lining, tubercles can often be seen. Occasionally vaginal ulcers perforate into the bladder or rectum and in this manner produce fistulas. Generally the converse is true, the lesion having its origin in the adjacent hollow viscus and from here penetrating to the vagina.

MILIARY.—The vaginal lining is thickened, reddened and more or less bathed in discharge. A varying number of small elevations, usually grayish or yellowish in color and sometimes partially translucent, are present. Occasionally one of these tubercles breaks down and a small ulcer results. Tubercles in varying stages of development are usually present.

HYPERTROPHIC.—This variety is nearly always secondary and usually the result of a hematogenic or lymphogenic infection. It is characterized by the formation of one or more tumor-like masses. The masses are usually condyloma-like in appearance and resemble similar lesions occurring on the external genitalia, except that, owing to the local conditions, such as pressure, moisture, etc., they are likely to be somewhat

modified. These are frequently discolored, the vaginal lining membrane about their base is thickened and reddened, while on the prominence of the tumor the covering is usually thinned or may be absent. Not infrequently these masses will soften and break down, leaving a more or less deep, ragged ulcer. A generalized vaginitis is often present.

The chief characteristic of all these varieties is their appearance of chronicity. As a rule, the ulcers do not bleed easily and are not markedly tender.

The fornices and the upper third of the posterior vaginal wall are the parts of the vagina most frequently attacked. The frequency of the latter location can be accounted for by the fact that this is the area that receives the uterine discharges. The upper part of the vagina is also more prone to vaginal lesions, owing to the frequent direct extension from cervical tuberculosis.

Diagnosis.—Only by a histologic or bacteriologic examination can a positive diagnosis be made. Tubercle bacilli can occasionally be demonstrated in the discharge, especially during the acute stage. However, the presence of tubercle bacilli in the discharge does not prove that there is a tuberculosis of the vagina, as the microorganism may have been swept down from the lesion in the upper genital tract. In order to determine this point, Schultze's method may be employed. This consists in thoroughly cleaning the vagina and external genitalia and then inserting a tight fitting occlusive tampon of sterile absorbent cotton against the cervix. If the secretion that collects in the vagina below the tampon contains tubercle bacilli, this is evidence that a vaginal lesion is present, whereas, if the upper surface of the tampon is alone contaminated, it is evident that the infection is confined to areas above. Urinary contaminations must be excluded. A better method is, after thoroughly cleaning the vagina, to perform biopsy or to curette the vaginal lesion and examine the material thus obtained for tubercle bacilli and histologic evidence of the disease, or to use this material for animal inoculation, or preferably to employ both methods. Curettage is applicable only to the ulcerative variety of lesion. When possible, total excision of the suspected area is preferable to any other method, although no positive rules can be formulated in this respect, and curettage or the examination of the discharge by Schultze's method may be advisable as a preliminary step. In no case in which there is the suspicion of malignancy is delay justifiable. The presence of tuberculosis in other parts of the body, the slow onset and progress of the disease, and its general chronic character, together with the appearance of the lesion, should at least lead to the suspicion of this form of infection. Syphilis, malignant neoplasms,

chancroid, the various forms of vaginitis, and in children especially, gonorrhea, noma and diphtheria must be differentiated.

Treatment.—This, in general, is similar to that suggested for the treatment of vulvar lesions. In mild cases curettage, followed by the application of tincture of iodine or other chemical agents, or by the actual cautery, may suffice to produce at least temporary relief, but excision offers better hopes of a permanent cure in the ulcerative or hypertrophic varieties, and may even be employed for its palliative results, if thought advisable. Naturally much depends upon the character and extent of the lesion. Localized lesions should, as a rule, be excised, but when large areas of the vagina are involved this may be impossible, and less vigorous methods may have to be resorted to. In cases in which the upper genital tract is involved hysterectomy may be required, as it is obviously difficult to cure a vaginal lesion which is constantly being re-infected by a tubercle bacilli bearing uterine discharge. Unfortunately, the majority of these cases are secondary, and treatment directed towards the vaginal condition is at best but palliative.

As has been stated previously, many cases of vaginal tuberculosis are associated with vulvar lesions; a similar association with cervical infection is frequent. Therefore, to obtain a full list of all vaginal lesions the reader is also referred to the reports of tuberculosis in both these other areas.

CASE HISTORIES

Havas.⁹ Ulcers were found at the introitus vaginae of a 27-year-old prostitute. These were about the size of lentils or somewhat smaller, rather deep, granular, and covered with a yellowish detritus, with undermined edges. A diagnosis of gonorrhea had been made, but this was revised when it was discovered that secretions from the ulcers yielded tubercle bacilli. The ulcers increased in size slowly, but steadily. The patient was also suffering from tuberculosis of the lungs.

Davidsohn.¹⁰ Patient had general miliary tuberculosis, also tuberculosis of the vagina, uterus, and adnexa. The vaginal mucosa was reddened, swollen and inflamed. Scattered on the surface were a number of small semitranslucent, yellowish elevations. Considerable discharge was present. A number of ulcerations at the intravaginal orifice were also present. Histologic examination of the vaginal lesion proved them to be miliary tubercles.

Zweigbaum.¹¹ Patient was 32 years of age. She had an ulcer on the cervix and, later, one which involved the vagina and left labium

minus. The latter was of moderately large size. A portion of one of the ulcers was excised and found to contain large numbers of tubercle bacilli. The patient subsequently succumbed to pulmonary and intestinal tuberculosis. Despite the fact that the genital lesions antedated by some months any evidence of tuberculosis elsewhere in the body, Zweigbaum very properly considered the case a secondary one.

Emanuel.¹² Tuberculosis of the vulva and vagina was secondary to a cervical lesion. The entire peritoneum was involved by an ulcer. Tuberculosis was diagnosed histologically, and tubercle bacilli were demonstrated. The ulcers were extremely extensive.

Demme.⁸ Case 1. A child of seven months had a tuberculous ulcer at the vaginal orifice. The father was tuberculous.

Case 2. A child of fifteen months had a mucopurulent discharge after measles. An ulceration was present at the entrance of the vagina which, upon histological examination, proved to be of tuberculous origin. An inguinal adenitis was present and tubercle bacilli demonstrated from this region. The child died of pulmonary tuberculosis.

Gorfida.¹³ Primary Tuberculosis of the Vagina and Vulva. The patient was a woman, 23 years of age. Following the birth of her child, a laceration of the posterior vulvar commissure was found. Two months later she noticed a sense of burning in the vulvar region, this increased to pain, which was attended with a yellowish discharge. Nocturnal elevations of temperature and somewhat later a swelling in the left inguinal region appeared, followed by an involvement of the right inguinal lymphatic glands. The external genitalia increased in size, especially the right labium majus. The vaginal lining became thickened and ulcerations, which, however, did not involve the cervix or fornices, presented themselves. The uterus was normal in size and anteverted. Smears of the vaginal secretion revealed tubercle bacilli. The inguinal glands were removed and, although cauterized with iodine, the vaginal ulceration did not show any improvement. Finally, after curettage of the ulcer, the thermocautery was used, and the condition finally became cured. Histological examination of the scrapings of the ulcer showed tuberculous lesions, but no tubercle bacilli. Pieces of the inguinal glands, injected under the skin of rabbits, produced tuberculosis in these animals. The case is interesting not only because the ulcerations were primary, but because it developed during the puerperium. The author believes that the midwife transmitted it to the patient from another case of tuberculosis that she had been attending.

Karajan.¹⁴ Girl, 2 years old, whose hands were frequently on genitalia. There had been a swelling on the genitalia since 1 year of age.

No fever, cough, or diarrhea, etc., were present. On separation of the swollen labia majora a penis shaped tumor was revealed, which measured 3×1.5 cm., with small areas of loss of tissue substance, each about the size of a pin's head. This tumor represented the clitoris, the distal extremity of which is covered by an eczematous prepuce, and had been present one year. Examination and voiding of urine caused pain. The upper genitalia were normal. The tumor was excised and ten months afterwards the patient returned, showing a recurrence occupying the vestibule and vagina. The pain on urination had persisted, as had also the swelling and reddening of the external genitalia. Painful inguinal adenitis was present, also a tumor, 2 cm. in length, at the site of the scar. An ulcer was found on the right side of the vagina. No tubercle bacilli were demonstrated in the discharge from the tumor. Histologically, tubercles with giant cells were observed in the skin and subcutaneous tissue of the tumor. Tubercle bacilli were present.

Denme.⁸ Case 1. Woman, aged 39 years. The growth about the vagina first began as a small increase in size of the labia minora, followed by small polypoid vegetations, which grew slowly and obliterated the vagina completely. A large ulceration developed in the vestibule and finally destroyed the urinary meatus and urethra. The inguinal glands were not enlarged. A plastic operation was performed. Giant cells and tubercle bacilli were found in the vegetation and in the tissue of the labia minora.

Case 2. Woman, aged 50 years. Six years previously she had an ulceration of the external genitalia with inguinal adenitis. The patient communicated the trouble to her husband, who died quickly of "tisi e suppurazione d'airbedue i test coli." After some years there appeared small tumefactions in the vulvar region, which was ulcerated. The vagina became involved and then the clitoris. The greater lips became enlarged and wart-like. A secondary tumor of the buttocks was present. The entire tumor and hypertrophied tissue was excised. The tumefied masses showed tuberculosis nodules histologically, but the sections of the labia majora did not; nor did those of the clitoris.

The following cases are among those collected by Chaton:¹⁵

Emanuel.¹⁶ Woman, aged 50 years, had miliary tuberculosis of the liver, spleen, and peritoneum. The uterine cavity was filled with caseous masses, and tuberculous ulcers of the cervix and vagina were present. The tubes and ovaries were normal.

Rigal.¹⁷ The patient had a miscarriage at the sixth month and died shortly afterwards from a general miliary tuberculosis of the lungs,

peritoneum, and meninges. Tuberculosis of the vagina and cervix were present.

Hamolle.¹⁸ Patient aged 57 years. She had pulmonary and peritoneal tuberculosis. At autopsy tuberculosis of the cervix, uterus, tubes, and vagina was found, the disease manifesting itself in the latter locality, as small, deep ulcerations, which had undermined edges, moderately firm bases, and were chronic in appearance. The tuberculous character of her lesion was proven by histologic examination.

Mosler.¹⁹ The patient was an old woman 75 years of age. A pulmonary tuberculosis had been present for some time. The cervix and vagina were the seat of an ulcerative lesion, the tuberculous character of which was determined by histologic examination. A number of miliary tubercles were also present in the vaginal mucous membrane. A tuberculous endometritis and adnexitis were also present.

Weigert.²⁰ The patient was aged 76 years and had pulmonary and peritoneal tuberculosis. The cervix was the seat of an ulcer; ulcerations were also present in the vagina. The tuberculous character of the genital lesion was proven by histologic examination.

Winter.³ The woman suffered from a pulmonary tuberculosis for some time prior to the appearance of the genital lesions. The vagina was the seat of tuberculous ulceration, the character of which was proven by histologic examination. The uterus and adnexa were also involved.

Jellett²¹ reports the history of a case of extensive tuberculosis of the uterus, adnexa, and rectum. There was a rectovaginal fistula.

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CHAPTER VIII

TUBERCULOSIS OF THE CERVIX

Cases proved by histologic or bacteriologic examination—Forms of infection—Primary and secondary—Causes—Cases on record—Coincident tuberculosis of other parts of genital tract—Tuberculous salpingitis with or without involvement of the corporeal endometrium a common accompaniment—Predisposing causes—Analysis of cases verified by histologic or bacteriologic examination—Average age arranged in decades—Classification of cervical lesions—Ulcerative, papillary, miliary, and interstitial—Analysis of cases—Hemorrhage—Pain—Histologic examination—Cases—Tuberculosis of the body of the uterus—Endometritis—Bibliography.

HISTOLOGIC AND BACTERIOLOGIC EXAMINATIONS

In 1831, Raynaud¹ reported the history of a case in which the uterus and adnexa were the seat of a tuberculosis and an ulcer was present on the cervix.

In 1853, Virchow² reported the first authentic case of tuberculosis of the cervix, and the following year Kiwisch³ reported a similar case. Chaton⁴ gives Rigal⁵ credit for the priority of recording the first case fully verified by histologic examination. Since Virchow's report, a large number of cases have been recorded. In many of the earlier cases, however, the diagnosis is not fully verified and even some of the more modern reports are not above suspicion. In the formulation of the statistics which occurs in the following pages, care has been observed to utilize only such cases as have been proved by histologic or bacteriologic examination. In many authentic cases important points are lacking, and this accounts for the different number of cases utilized in the different series of statistics.

Tuberculosis of the cervix is a rare infection. Indeed, Chaton⁴ believes it less frequent than vaginal lesions. Our search through the literature has not, however, confirmed this opinion. Späth⁶ found that the cervix was affected six times in a series of 119 cases of genital tuberculosis occurring in the female; Mosler,⁷ in 46 cases of like material, found the cervix involved four times. In the study of 66 tuberculous gynecological specimens in the gynecological laboratory of Pathology at the University of Pennsylvania, all of which have been subjected to

histologic examination, there has been 1 case in which the cervix was involved. This, however, represents a higher percentage than is usually observed.

Tuberculosis of the cervix may be primary or secondary, the latter being by far the most frequent. It may result from direct infection, from extension, or may be metastatic, to use the Connheim expression, from distant foci by way of the blood or lymphatics. In 1902, Broucha⁸ recognized only 4 cases as primary, those reported by Klobb,⁹ Kaufmann,¹⁰ Michäles,¹¹ and Broucha⁸ and Chaton,⁴ in their careful review of the literature pertaining to this subject six years later, were willing to admit only two additional cases (Brooks¹² and Ferrari¹³). Of 69 cases studied by Beyea,¹⁴ 9 were apparently limited to the cervix. Among the reports of 90 cases, the histories of which have been examined by the author, 14 are stated to have been primary, that is, no other foci of tuberculosis was discovered. Primary cervical tuberculosis is, however, probably less frequent than these figures would indicate, as it is likely that in not a few of these cases the original lesion has been overlooked, owing, perhaps, to its quiescence or even resolution.

Zweigbaum's¹⁵ case can be pointed out as an instance of this condition. At first no other foci of infection could be found, even after a thorough examination. Zweigbaum, however, knowing the rarity of primary lesions of the cervix, refrained from classifying the case as a primary one. Subsequently this patient developed a general tuberculosis, from which she died. Other similar instances are on record. The difficulty of sometimes determining whether certain cases of genital tuberculosis are primary or secondary has been discussed elsewhere. A few undoubtedly primary cases have been reported, and if we accept these, it is theoretically possible for such lesions to cause secondary involvement of other parts of the body. Such a possibility is, however, too remote to be considered of practical importance.

Coincident tuberculosis of other parts of the genital tract is by no means uncommon; thus, direct extension from the portio to the vagina is not infrequent. Tuberculous salpingitis, with or without involvement of the corporeal endometrium, is a common accompaniment (Fränkel¹⁶). Indeed, so often is salpingitis present that this circumstance has led Montanelli¹⁷ to recommend hysterosalpingo-oöphorectomy in all cases. Numerous cases are on record in which the cervical lesions have been diagnosed as cancer and complete operation performed, and only after the removal of the specimen, or at operation, have the adnexal lesions been discovered. In some cases the tubes may be normal and the only other genital lesion an endometritis.

The frequency of the latter complication is disputed by many authorities, some believing it common, and others remarking upon its rarity. It appears, however, that the more thoroughly these cases are examined, the more frequently are corporeal lesions discovered, and this is in accord with what would be expected from a study of the biology of tubercle bacilli and the anatomic relationship of these two areas. Tuberculosis by extension is relatively by no means infrequent in the external genitalia, vagina, and cervix, and extension from the corporeal endometrium downward or from the cervix upward is not, therefore, surprising. Lepetit¹⁸ believes that in his case the disease spread from the cervix to the body of the uterus.

In a study of 47 cases of cervical tuberculosis, involvement of some portion of the genital tract above the internal os was reported in 36. Veyrat,¹⁹ in a series of 89 cases of cervical tuberculosis studied, found pulmonary lesions present in 42 per cent. Lung lesions are naturally the most frequent primary foci, but numerous other localities have been recorded. Thus Kromer²⁰ reports a case in which the only other focus of disease was a cutaneous lesion on the buttock. In Fabricius's²¹ case an intestinal lesion was present and a hairpin had been introduced into the rectum, perforated the vagina, and penetrated the cervix; and in the wound on the latter a typical tuberculous ulcer developed. A number of authors have attributed their cases to direct infection through coitus, the husbands of these women presenting genital tuberculosis (Glockner²² and Michäles¹¹). Frank²³ believes the infection in his case was communicated by the hand or by soiled linen; this, however, is questionable, as the patient gave a history of a previous tuberculous bone disease.

Predisposing Causes.—Beyond the presence of tuberculosis in other parts of the body and especially of the genital tract, little is known regarding the predisposing causes to cervical infection. An analysis of 29 cases, all of which were verified by histologic or bacteriologic examination, showed that 5 occurred in virgins, 17 in nulliparas, and 7 in multiparas. In a larger series of cases, in all of which the diagnosis was not positive, the proportion of multiparas was found to increase very materially; indeed Chaton⁴ states that patients affected with tuberculosis of the cervix are usually multiparas. It would seem, however, that lacerations, or rather the result of laceration, such as cicatricial tissue, hypertrophies, and eversions, play but a small part in the etiology of this condition. There seems to be little doubt that recent laceration and trauma, by the production of loss of continuity and the opening up of avenues of infection, and, perhaps, by producing areas of lessened

resistance, are, to a certain extent, predisposing agents. Braye's²⁴ and Rigal's²⁵ cases followed miscarriages of three and six months, respectively. Thiercelin's²⁶ case also followed a miscarriage. Animal experiments bear out the assertion that loss of continuity and trauma are predisposing agents to infection by the tubercle bacillus. Martin²⁷ remarks upon the strangeness of the fact that tuberculosis does not follow the emptying of the pregnant uterus more frequently in cases known to have tubercle bacilli in the uterine discharge. Preëxisting inflammation probably plays an important part as a predisposing agent. This is an established factor in the production of vaginal and vulvar lesions, as well as in tuberculous salpingitis.

No age is immune; the disease, however, is most frequently met during the active sexual life. An analysis of 116 cases shows that the average age was 29.3 years, the extremes being three years (Mosler⁷), 72 and 75 years (Kaufmann¹⁰ and Menetrier²⁸). Arranged in decades, the 116 cases present the following results:

<i>Years</i>	<i>Cases</i>	<i>Per Cent</i>
I to 10	2	1.8
11 " 20	6	5.3
21 " 30	60	53.1
31 " 40	25	22.5
41 " 50	11	9.9
51 " 60	4	3.6
61 " 70	6	5.3
71 " 80	2	1.8

These statistics closely coincide with those of Beyea,¹⁴ Chaton,⁴ and Lannes-Dehore,²⁹ who found the greatest number of cases occurring between 21 and 41 years of age. Hager (quoted by Chaton⁴), Alterthum,³⁰ Morlitte,³¹ Landouzy (quoted by Chaton⁴) and Fournier (quoted by Chaton⁴) believe that hypoplasia or faulty development of the genital tract is to some extent a causative agent in the development of cervical tuberculosis. In cases examined by the author no such connection was determinable.

Symptoms.—Cervical tuberculosis being usually secondary, symptoms of pulmonary lesions are frequently present, while a history suggestive of a general or pelvic peritonitis is by no means uncommon. As a result of a primary lesion in other parts of the body, the patients

are often emaciated and may suffer from pyrexia, hemoptysis, anorexia, night sweats, etc. None of the symptoms resulting from the cervical lesions are pathognomonic. Discharge, hemorrhage, and occasionally pain or itching, constitute the symptom complex. Amenorrhea, which is present in a considerable proportion of cases, is generally due to other factors than the cervical lesion, such as the menopause, an occlusion in the cervical canal causing a pyometra, or it may be secondary to a pulmonary lesion. Amenorrhea was present in 42 per cent of the 28 cases of cervical tuberculosis studied by Murphy.³⁹

DISCHARGE.—If the disease be advanced, more or less discharge is certain to be present. This varies from a thin, irritating leukorrhea to a thick fetid, glairy, material. As necrosis advances, the discharge usually becomes yellowish or brownish, and may contain cheesy particles. As a rule the discharge is malodorous but is occasionally inoffensive, especially in the early stages before much destruction of tissue has occurred. Not infrequently it may be blood streaked; this is especially likely to be the case following trauma. In the interstitial and miliary varieties, discharge is a less marked feature, and is rarely sanguineous. As a result of the discharge itching and burning in the vagina and about the external genitalia may occur, while a well marked pruritus vulvae and lesion of the vagina and external genitalia may result.

HEMORRHAGE.—Variations in the menstrual cycle, as to periodicity and amount lost, are by no means infrequent, but are usually the result of a corporeal endometritis or adnexitis. If the primary focus be in the lungs, menstrual disturbances from this source are frequent. This latter condition will be described in detail in a subsequent chapter.

The hemorrhages produced by the cervical lesion in themselves vary markedly, but are usually in the form of "spottings" and follow trauma, such as examination, coitus, etc. In some cases the lesions have shown little tendency to bleed, while in others a vascularity and friability strongly suggestive of carcinoma have been present. As would be expected, the miliary and interstitial varieties are less prone to produce hemorrhage than are the ulcerative and papillary.

PAIN.—Since the cervix contains few sensory nerves, pain is rarely a marked feature. As the disease advances and absorption takes place a cellulitis of the base of the broad ligament, with its resulting symptoms, is by no means uncommon. As a result of lesions in the upper genital tract and pelvic peritoneum, pain in the lower abdomen is not infrequently encountered. As a result of the cervical lesion, occlusion of the cervical canal may occur, and result in a pyometra, as in one

of the cases of Pollosson and Violet.⁴⁰ If this occurs, enlargement of the uterus and more or less pain is prone to occur. Spread to the adnexa and pelvic peritoneum, produces the symptoms characteristic of these lesions. The macroscopic appearances of the different varieties of cervical tuberculosis naturally vary widely.

Varieties.—Pozzi describes three varieties, the ulcerative, vegetative, and miliary, to which Schutt³² has added a catarrhal form, examples of which are the cases of Meyer,³³ Giglio,³⁴ Sippel,³⁵ and Schutt. This variety is rejected by Chaton.⁴ Cotte³⁶ has described an inflammatory variety which closely simulates an endocervicitis, glandular, periglandular inflammation and changes in the surface epithelium being the chief features.

The most satisfactory classification is that which divides the cervical lesions into four groups, the ulcerative, the papillary, the miliary, and the interstitial. Of these, the ulcerative and papillary are the most frequent, the miliary and interstitial being comparatively rare varieties. An analysis of 106 cases shows 52 to have been ulcerative, 41 papillary, 7 miliary, and 6 interstitial. These statistics are, however, to some extent misleading, as combinations of the various forms, especially the ulcerative and papillary, have been present frequently; while it is probable that, if these cases could have been examined in their incipiency, the interstitial and even perhaps the miliary would have been found more often. The interstitial variety, like the similar form of cervical cancer, does not produce marked symptoms until the disease has broken through to the surface of the portio or the canal, and when examined at this latter time, is doubtless frequently classed as the ulcerative variety.

Chaton, in his analysis of cases, found 37 ulcerative, 22 papillary, and 7 miliary. Cova³⁷ thinks the papillary variety frequently presents ulcerations. Patel³⁸ states that 50 per cent of the cases are of the ulcerative variety. In the secondary cases, the cervical lesions do not necessarily follow the type of the original foci. Thus a general miliary tuberculosis may result in an ulcerative, papillary, or other form of lesion.

An analysis of 14 primary cases showed 8 to be of the ulcerative variety and 6 of the papillary. It is doubtful if all of these cases are primary. Not infrequently specimens are reported as primary upon insufficient evidence.

Beyea¹⁴ analyzed 59 cases of cervical tuberculosis with a view to ascertaining the portion of the cervix attacked. In these the portio was involved alone in 11, the supravaginal cervix alone in 6, and both in 42. The primary lesion in the cervix is usually in the canal, regardless of the variety.

ULCERATIVE VARIETY.—These lesions vary considerably in size and appearance. In some specimens they are large and the place of the entire vaginal cervix is occupied by the ulcer, as in the case of Bonilly.⁴¹ Not infrequently the adjacent vagina is involved. In other instances the ulcers are small and may resemble a chancroid, as in the case of von Franke.⁴² Usually the external os is the starting point, the disease spreading from this location toward the vagina eccentrically. The lesions may be situated upon the portio or in the cervical canal. In the cases of Nanard,⁴³ and Broucha⁸ the ulcers were almost entirely within the cervical canal. Or the lesion may commence on the portio and spread upward, involving the endometrial cavity, as in the case of Lepetit,¹⁸ or the converse may be the case.

In some instances the lesions are shallow and surrounded by clean cut, slightly raised margins; more frequently, and especially in advanced cases, the ulcers are moderately deep and present roughened, swollen, and often undermined edges. The base and edges may be fairly smooth and contain numerous raised concentric elevations, often yellowish and grayish and partially translucent; or the sides and base may be covered with darkened, necrotic material and a general worm-eaten appearance be present, or the surface of the ulcer may be granular. Occasionally there is attached to the ulcer, yellowish, cheesy material. The ulcers may be multiple, but are more frequently single. The lesions usually bleed moderately, easily, although in a few instances this sign has been absent. As a rule the bleeding is less marked than in carcinoma and the lesions appear more chronic. On palpation the base of the ulcer generally presents a soft velvety feel. The friable character can, however, frequently be detected by the touch. The cervix is generally enlarged.

PAPILLARY.—In this form there is an outgrowth from the cervix of more or less cauliflower-like masses; when first examined these are usually dark, reddish or brownish in color and covered by discharge. Not infrequently nodular elevations, sometimes of moderate size, are present. If the latter be removed, or after excision, these are found to be papilloma-like masses, red, yellow, gray, pink, or white, often somewhat translucent, and frequently contain areas of necrosis. The papillary variety generally affects the portio, but may originate from the cervical canal. As a rule this type is moderately friable, and as a result bleeds easily. In some cases, however, especially when small, and before much breaking down has occurred, the masses are moderately firm and exhibit but little tendency to bleed on touch. The papillomata may spring from a broad base or more rarely be definitely peduncu-

lated. They may be single or multiple. In some instances there is a papillary endocervicitis, and more or less spreading outwards through the external os of small polypoid masses, as in the cases of Pollosson,⁴⁰ Beyea,¹⁴ and Lewers;⁴⁴ or the outgrowths may originate from the portio, as in the cases of Cornil⁴⁵ and Giglio.³⁴

Emanuel,⁴⁶ Ferrari,¹³ also Ressegna⁴⁷ and Vitrac⁴⁸ have observed a form that exists as a distinct tumor, more or less pedunculated and friable, the origin of which is variable, but usually from the portio. This has been described by some of the French writers as the "vegetante neoplastique" variety. In many specimens the fungus-like masses closely resemble carcinoma. The cervix is usually enlarged and the surface of the portio not covered by outgrowths is reddened. Sometimes this variety affects the external os, as in the case of Hofbauer,⁴⁹ and sometimes the canal (Beyea¹⁴ and Lewers⁴⁴). Pollosson and Violet⁴⁰ especially emphasize the fact that the disease may occur as a localized intracervical polypoid condition.

MILIARY.—In this variety the cervix is enlarged, reddened, turbid, and small, somewhat pale yellowish, or grayish, partially translucent elevations may be seen beneath the surface epithelium. These are usually solid, but may contain turbid fluid or cheesy material. The mucosa at the external os may be normal or may be thickened, swollen and inflamed. In some instances the tubercles are limited to the mucosa of the canal, but more frequently the portio is also involved. The surface of the portio between the tubercles sometimes presents a granular appearance, and a general tendency towards fibrosis is often observed. Instructive reports on this variety of lesion may be found in the contributions of Rigal,⁵ Cornil,⁵⁰ Zweigbaum,¹⁵ Denville,⁵¹ Vitrac,⁴⁸ and Bouffe.⁵²

INTERSTITIAL.—This variety begins in the substance of the cervix, which becomes enlarged, usually asymmetrically. As the disease advances, a localized necrosis occurs, which eventually breaks down into the canal, or more often on to the portio, leaving a ragged, undermined opening leading into the primary cervical focus. In the latter stages, a deep, undermined ulcer is present, which is lined by necrotic tissue, blackish or, in some instances, yellowish in color. Tubercles may be present in the friable floor or walls of the cavity and in the adjacent surface.

Combinations of these varieties are frequent, especially of the ulcerative and papillary.

Diagnosis.—As has been stated, tuberculosis of the cervix produces no symptoms that are by any means pathognomonic. In no case can a

positive diagnosis be arrived at without the aid of the microscope. The majority of cases have been diagnosed clinically as carcinoma and the true character of the lesion ascertained only by a histologic examination.

<i>Tuberculosis of the cervix</i>	<i>Carcinoma of the cervix</i>
No age is immune. Most frequent in active sexual life.	Rare in the extremes of life. Most frequent between 35 and 50 years.
There is a history of tuberculosis in other parts of the body, in the majority of cases.	Such history is infrequent.
Nullipara by no means immune.	Extremely rare in women who have never been pregnant.
Local symptoms may have been present for a prolonged period.	Course of the disease more rapid.
Tubercles may often be observed in the lesion or on the adjacent structures.	Tubercles absent.
The margin of the ulcer is usually undermined and fairly soft.	Usually elevated and indurated.
Floor of the ulcer is moderately soft and may contain numerous macroscopic grayish or yellowish semitranslucent tubercles.	Hard and nodular. Tubercles are absent.
Usually bleeds readily but not always.	Bleeds more readily.
The discharge may contain cheesy masses and tubercle bacilli, as shown by staining, inoculation, or culture.	Necrotic tissue, which presents the histologic characteristics of cancer. Tubercle bacilli absent.

As stated above, tuberculous lesions of the cervix are usually softer and less indurated than carcinoma. The appearance and friability may

be suggestive of carcinoma, but the less indurated and, indeed, often velvety sensation of the tuberculosis is usually in marked contrast to the cancer. Even if distinct nodules are present, these are usually softer than cancer. To the experienced surgeon this is a valuable sign and should in itself, at least, suggest the possibility of tuberculosis. In examining the literature pertaining to this subject, the reader cannot fail to be impressed with the frequency with which this differential diagnostic point is mentioned.

Despite the above differences, many cases will be encountered, in which a clinical differentiation is impossible, and in all in which doubt exists, biopsy should be resorted to, the excision being performed with a cautery knife heated to a dull red. As carcinoma is so much more frequent than tuberculosis, this fact should be borne in mind, and no time lost in arriving at a diagnosis. In not a few cases, tuberculosis of the cervix has been clinically mistaken for sarcoma (Cornil,⁵⁰ Fränkel,¹⁶ Kaufmann,¹⁰ Giglio,³⁴ Vitrac,⁴⁸ and Emanuel⁴⁶) and its true character only recognized after histologic examination.

In addition to the differentiation from malignant neoplasms, the ulcerative and papillary varieties must be distinguished from lacerations, hypertrophies or eversion the result of childbirth, other inflammations such as gonorrhea, chancre, and the papular and ulcerative syphilides, gumma, chancroid, condylomata acuminata, benign polyp, leukoplakia, fibromyomata, and sarcoma. With the exception of the last named, no great difficulty exists in excluding these conditions.

The miliary variety must be distinguished from other inflammatory lesions, especially when the latter are associated with laceration and eversion, or nabothian cysts, hypertrophies, and subinvolution.

The interstitial variety, if observed in its early stages, may be confused with interstitial neoplasms, retention cysts, laceration or hypertrophies. The differential diagnosis between tuberculosis of the cervix and the above named conditions, with the exception of the malignant neoplasms, usually presents no unusual difficulties.

Prognosis.—If tuberculosis of the cervix be primary and localized, the prognosis is favorable, provided the proper treatment be adopted. In determining that a given case is primary, extreme caution should be observed. As the great majority of cases are secondary, the prognosis depends to a large extent upon the character of the primary lesion. As a general rule, in secondary cases the prognosis is grave; however, cures have been reported in a number of instances.

In the great majority of the reported cases the ultimate outcome is not stated. Beyea's¹⁴ statistics show that, out of 10 cases subjected

to panhysterectomy, 3 died soon after the operation—1 from shock, 1 from tuberculous peritonitis, and 1 from an aggravation of the lung condition: of the 7 remaining, 6 were well some years after the operation; and in 1 four months had elapsed. Statistics of this type are, however, misleading. The chief condition in the large proportion of cases being the primary focus, its extent, character, amenability to treatment, the apparent virulence of the infection, the patient's age, social status, etc., are all points which should be considered in rendering the prognosis, as well as the condition of the upper genital tract.

Treatment.—This, also, is dependent upon whether the case is primary or secondary. In the former event a panhysterectomy or, if the lesion is small and entirely limited to the vaginal cervix, a high trachelectomy, is indicated. If the latter operation is selected, a curettage should be performed and the curettings from the body of the uterus examined histologically for the purpose of excluding a tuberculous endometritis. If curettage is performed, especial precaution should be instituted to prevent carrying tubercle bacilli from the cervix to the endometrial cavity. As an additional safeguard, it is advisable, as a final step in the curettage, to apply tincture of iodine to the denuded uterine cavity. In patients past the child bearing period, or who already have a number of children, an abdominal panhysterectomy is preferable in most cases, for by this means a thorough examination can be made and the condition of the adnexa ascertained beyond the question of a doubt. The exposure of the peritoneum to the air is also of advantage in cases in which either general or local peritonitis is present.

Chaton⁴ and Petit-Dutailis⁵³ favor the vaginal route in these cases. The former states that in 15 vaginal hysterectomies there were 2 deaths; and among 8 abdominal hysterectomies 2 deaths occurred and 2 local recurrences. The question of which route shall be selected is largely a matter of choice with the individual surgeon. The author prefers the abdominal route. The fact that the corporeal endometrium and the adnexa are involved in the tuberculous process in a large proportion of cases should also be borne in mind in selecting the operation. Patel⁵⁴ especially recommends excision in the hypertrophic varieties of the disease. In cases in which there is involvement of the upper genital tract or peritoneum, hysterectomy is generally the most satisfactory operation.

If pulmonary phthisis or other distinct foci are present, their extent and character should decide the treatment to a large extent. Palliative measures are usually preferable in advanced cases. The amount of discomfort produced by the genital lesion must, however, be considered.

In this respect, each case is more or less a law unto itself. The general tendency is very properly to treat these cases surgically when the primary focus is of such a character as to permit operation. This subject of treatment of secondary lesions will be more thoroughly considered under a separate heading in a subsequent chapter. Murphy³⁹ states that of 11 cases treated palliatively, 1 recovered, 5 were temporarily improved, and in 5 the disease progressed. Petit-Dutaillis⁵³ has reported the history of one case which recurred six years after a curettage and cauterization with the actual cautery. In 1903, Murphy³⁹ advised against hysterectomy in primary cases, stating that the operation gave a 30 per cent mortality. We feel that, with our present methods of operating in uncomplicated cases, this is far in excess of the actual figures, and that three or four per cent would be the maximum under favorable circumstances.

Curettage of the cervix, followed by cauterization, either with a zinc chlorid or preferably with the actual cautery, may be employed as a palliative measure in cases with advanced primary lesions. Radium, or the Röntgen rays have apparently produced good results in some cases. Radium or the X-Rays are positively contraindicated, if a salpingitis is present. Under such circumstances either of these methods of treatment is prone to light up the infection and produce serious consequences. In these, as in all other cases of genital tuberculosis, particularly in the secondary variety, the after treatment is of the utmost importance. This will be considered in detail in a subsequent chapter.

CASE HISTORIES

Haultin.⁵⁵ Single, 35 years of age. Menstruation was normal. For several months there had been increasing leukorrhea. Examination of the cervix showed it to possess a rough, irregular outline, not friable, and did not bleed easily. It was purplish in color, and more or less covered with papillomatous outgrowths and bathed in a thick, yellowish discharge. The body of the uterus was normal. A high trachelectomy was performed. The specimens showed the usual histologic picture of tuberculosis, and tubercle bacilli were demonstrated in the tissue by staining. The case is of especial interest, as it was apparently primary. No history or physical evidence of tuberculosis in any other parts of the body could be demonstrated. Furthermore, the patient was well sixteen years after the operation. The fact that she was single, and that the hymen was intact would tend to exclude the

ordinary routes of direct infection. The most pronounced histologic changes were, however, on the portio vaginalis.

Montanelli¹⁷ furnishes brief records of eleven cases of tuberculosis of the cervix uteri, from the Royal obstetricgynecological clinic at Florence, reporting two of these cases in detail.

Case 1. Patient aged 38 years and nullipara, in whom the onset of menstruation had been delayed. The menses were abundant and frequent. She had leukorrhea and papillary tuberculosis of the cervix.

Case 2. Woman, aged 41 years and nullipara. The menses were always irregular, had leukorrhea, and bleeding after coitus. Interstitial tuberculosis of the cervix with marked glandular hyperplasia was present.

Case 3. Woman aged 40 years, and had one child. The patient had leukorrhea for eight months, and sometimes bleeding. Papillary tuberculosis of the cervix was diagnosed.

Case 4. Patient aged 39 years had tuberculosis of the peritoneum, adnexa, and cervix.

Case 5. Woman aged 18 years and nullipara. She had abdominal pains, and amenorrhea had existed for six months. Papillary tuberculosis of the cervix was diagnosed, with partial ulceration.

Case 6. Woman, aged 44 years, and decipara. The patient had leukorrhea, and abdominal pains. Interstitial tuberculosis of the cervix with involvement of the body of the uterus, adnexa, and peritoneum, was present.

Case 7. Patient aged 26 years, was a nullipara, and had irregular menses and caseous masses in the uterine cavity. Papillary tuberculosis of the cervix, and tuberculosis of the adnexa and peritoneum were present.

Case 8. A woman, aged 25 years, who had been married three years, but had never been pregnant, sought advice for amenorrhea, which had persisted for some months. Examination showed the body of the uterus normal in size and position. On the portio was an erosion which bled easily and a polyp protruded from the external os. Curettage and histologic examination verified the diagnosis and panhysterectomy and bilateral salpingo-oophorectomy was performed. The cervix, the body of the uterus, and the right tube were found to be tuberculous.

Case 9. This patient was a sterile married woman of 28 years. Menstruation was irregular for two years. The last period, five months ago, was followed by profuse leukorrhea. The uterus was normal in size. The cervix was the seat of a papillary growth, which bled easily. No tuberculous lesion could be detected in any part of the body, nor had

there been fever for fourteen days prior. The inguinal glands were slightly enlarged. Panhysterectomy was performed and tuberculosis histologically demonstrated in the cervix, endometrium and tubes.

Case 10. Woman, aged 51 years, and nullipara. The menopause occurred at 46 years and had had a bloody discharge for the last seven months. Papillary tuberculosis of the cervix was diagnosed.

Case 11. Woman, aged 39 years and nullipara. The patient had abdominal pains and leukorrhea. The condition was diagnosed as papillary tuberculosis of the cervix.

Montanelli¹⁷ believes the cervical lesions are often secondary to salpingitis and therefore recommends panhysterectomy and bilateral salpingo-oöphorectomy in all cases.

Alterthum.³⁰ Woman, aged 36 years and married, had abdominal pains and polypoid elevations on the posterior, cervical lip. Extensive pelvic inflammatory disease was present. On microscopic examination, tuberculosis of the polyp was diagnosed. The author makes no claim for the primary occurrence on the cervix in this case.

Smith.⁵⁶ A nullipara, aged 25 years, believed to have had a two and a half months' abortion a few months ago. This was shortly followed by pain in the right ovarian region, irregular hemorrhages, offensive discharge, and fever. Thus the history simulated one of septic abortion. The cervix was the seat of a soft, friable mass, which bled easily. The fundus and adnexa were normal. A provisional diagnosis of carcinoma was made, biopsy performed, and tuberculosis reported. The lungs were involved, and for this reason curettage and the application of zinc chlorid were decided upon.

Vineberg.⁵⁷ Case 1. Nonipara, aged 37. Regular and painful menstruation. Family history negative. Two and a half years ago suffered from a pleurisy with effusion, otherwise well. For last three weeks, pain in lower abdomen and fever, amenorrhea for two months, and had lost flesh and strength. Cervix hypertrophied and presented three ulcers. These were irregular in outline, moderately deep, and covered with a dirty grayish exudate. The remainder of the portio was reddened. There was no marked induration, no friability of the tissues, and no tendency to bleed when slightly traumatized. Tuberculosis of the body of the uterus and adnexa was present. Hysterectomy was followed by death. No autopsy. Histologic verification.

Case 2. Single woman, aged 25 years. Suffered from amenorrhea. Rather profuse leukorrhea and occasional attacks of pain in the right groin for two years. Her general health was good, and there was a good family history. Hymen was intact. Uterus small and anteflexed.

Cervix was soft and bled slightly to touch. Inspection showed the portio to be covered with vascular granulations. Case resembled a marked endocervicitis. Attached to the right wall of the cervical canal was a small cyst, the size of a cherry. This contained sebaceous material. This was not examined histologically. Trachelectomy and dilatation and curettage. Adnexa normal. Histologic examination of the amputated cervix verified the diagnosis. Vineberg considers this a primary case; at least no other focus of tuberculosis is referred to.

Martin.²⁷ Patient, aged 25 years, was married and nullipara. She had amenorrhea, leukorrhea, and pains in the lower abdomen and back. On histological examination, pieces of tissue from the cervix showed that the process was tuberculous and not cancerous.

Lorrain and Chaton.⁵⁸ Patient, aged 37 years, was married but had no children. She had prolapse of the uterus, hypertrophic elongation of the cervix, and bilateral inguinal adenitis. The cervical tissue was incised and tuberculous products removed by the curet. The histologic examination showed typical tuberculosis, but no tubercle bacilli could be demonstrated by staining. Injection of some of the material into a guinea pig was followed by tuberculosis in the animal.

Horrocks.⁵⁹ Woman, aged 34 years, who had pulmonary phthisis. The cervix was dotted over with grayish, opaque vesicles, with a red, pulpy substance between, which bled easily when touched, and resembled a malignant neoplasm. The ulcer felt rather soft. Hysterectomy showed the genital condition was limited to the cervix. A uterus septus was present. The patient made an uneventful recovery, and was discharged from the hospital cured. The diagnosis of tuberculosis was made on microscopic examination.

Garkisch.⁶⁰ Woman, aged 28 years, married but had had no children or miscarriages. She never menstruated. At external os was a polypoid projection. Biopsy was performed. Microscopic examination of tissue removed for diagnosis showed typical tubercles and giant cells. Hysterectomy was performed, and the corpus uteri and tubes were found to be involved. In spite of the fact that the woman presented no other evidence of tuberculosis, even on a careful examination, and the fact that her husband was healthy, the author hesitates to regard the case as primary. Normal convalescence.

Zeigbaum.¹⁵ Tuberculosis developed, apparently primarily, in the cervix, then vagina, and then left labium minus, on which there was a large ulcer. These were cauterized and apparently cured. She died later, however, from a general tuberculosis, so that it would seem at least likely that this was not a primary case of cervical tuberculosis, but

one in which the primary focus was for a time latent. The cervical lesion was of the miliary variety.

Emanuel.⁴⁶ A woman, aged 50 years, presented herself, suffering from profuse purulent, often blood streaked leukorrhea. The cervix was found to be enlarged to the size of an apple. The enlargement was due chiefly to a vegetative outgrowth. Deep necrotic ulcerations were also present. Some of the ulcers involved the vagina. The body of the uterus was also enlarged, and the endometrial cavity filled with caseous material. The adnexa were normal. A panhysterectomy was performed. The patient died, and autopsy showed that miliary tuberculosis was present in the liver, spleen, and peritoneum. The lungs were normal. Examination of the cervix showed the usual histologic picture of this condition.

Fränkel.¹⁶ Woman who died of Pott's disease. The mucosa of the cervix was covered with fungus-like masses. The vagina and body of the uterus were normal, but advanced tuberculous lesions of the tubes were present. The diagnosis was confirmed by histologic examination.

Broye.²⁴ This patient was married, and 24 years of age. Three months after a miscarriage she developed a tuberculous peritonitis, salpingitis, and oöphoritis. The cervix was the seat of a papilloma-like outgrowth, which, upon histologic examination, presented the usual appearance of tuberculosis in this locality. A tuberculous endometritis was also present, an interesting point being that the histologic changes were most marked at the placental site.

Rigal.²⁵ Patient had a miscarriage at the sixth month and died shortly afterwards. She had general miliary tuberculosis of the lungs, peritoneum, and meninges. The cervix uteri was the seat of an extensive ulcerative lesion, which had involved the adjacent vagina by direct extension. The edges of the ulcer were raised, edematous, and partially undermined. The diagnosis was based upon histologic evidence. Death and autopsy showed miliary tuberculosis of the lungs, peritoneal cavity, meninges.

Klobb.⁹ The specimen was discovered accidentally at autopsy in a woman who had died of an intercurrent disease. The lesion was almost the size of a cherry, and had its origin low down in the cervical canal. The character of the pathologic process was determined only upon histologic examination. A careful examination of the body at the post-mortem failed to show any other foci of tuberculosis present.

Kaufmann.¹⁰ Patient, aged 72 years. The external os was small, but the supravaginal portion of the cervix was notably thickened and enlarged. A section from this portion showed it to contain a cavity

lined with semitranslucent grayish granulations. The walls were distinctly firm to the touch. The mucosa of the cervical canal presented no marked alterations. On histologic examination tubercles, giant cells, and other evidences of this type of infection were observed. Tubercle bacilli were demonstrated by staining.

Michäles.¹¹ Patient, aged 33 years, was married and a nullipara. Her mother had died of tuberculosis. The patient's lungs were normal. A moderate amount of purulent discharge was the only marked symptom referable to the cervix. A moderate sized necrotic ulcer of the cervix was present, which was cured by excision. A tuberculous ulcer and granular hypertrophy of the adjacent mucosa was diagnosed histologically.

Brouha.⁸ A quintipara, aged 41 years, with a family history of tuberculosis. The last child was born fourteen years ago, at which time she suffered from a pelvic peritonitis and pleurisy. A curettement has recently been performed. Now complains of pain in the back and left iliac region. Constipation and leukorrhea. The anterior cervical lip was enlarged and reddened. Opening into the cervical canal, and evidently interstitial in origin, is an ulcer, the cavity of which is red and has a worm-eaten appearance. On biopsy histologic evidence of tuberculosis was discovered. The lungs were normal and no extra-genital foci of tuberculosis were found. Chronic pelvic inflammatory disease was present. Panhysterectomy and bilateral salpingo-oöphorectomy were performed. Although evidence of inflammation in the upper genital tract was present, no tuberculosis was demonstrated. The author believes the condition to have been contracted by direct infection through coitus. Brooks¹² reported the following year that the patient was in good health.

Ferrari.¹³ Case 1. Patient, aged 30 years. She was a nullipara and had a tuberculous ulceration of both cervical lips. Polypoid excrescences were also present. Microscopic examination showed tuberculosis. Vaginal hysterectomy was performed. The convalescence was normal and the patient was discharged from the hospital cured. No other foci of tuberculosis were demonstrated elsewhere in the body.

Case 2. The patient was a multipara, who presented papillary and nodular excrescences on the cervix. She had had irregular menstruation and discharge. A trachelectomy was performed and the diagnosis verified by histologic examination.

Giglio.³⁴ Patient was 28 years of age. The chief symptom was a profuse purulent and at times blood streaked leukorrhea. Examination showed the cervix to be the seat of a papillary outgrowth. A number

of ragged, irregular ulcers were also present. A diagnosis of sarcoma of the cervix was made. Vaginal hysterectomy was performed. Death occurred three months later from "poussee de granulie." Histologic examination revealed the true character of the cervical lesion. Tubercle bacilli were demonstrated by staining in the tissue.

Glockner.²² Patient, 20 years of age. She had a papillary tuberculosis of the cervix, resembling cancer. The husband had tuberculosis of the right testicle and epididymis. The author believes the infection resulted from coitus. A vaginal hysterectomy was performed, and resulted in a cure. The diagnosis was made by histologic examination.

Zweifel.⁶¹ Patient, 28 years of age, had a family history of tuberculosis. A ragged, irregular, necrotic ulcer of the cervix was present and diagnosed cancer. The ulcer extended upward and involved the endometrial cavity. A panhysterectomy was performed. Histologic examination showed the lesions to be tuberculous.

Mosler.⁷ The patient was a child 3 years of age, in whom the cervix, uterus, tubes, lungs, peritoneum, and intestines were all invaded with tuberculosis. Death. Autopsy. Diagnosis was confirmed by a histologic examination.

Hamolle.⁶² Patient, aged 57 years, had pulmonary and peritoneal tuberculosis, from which she died. The disease manifested itself in the cervix and vagina as small deep ulcerations and here and there papillary masses.

Bender.⁶³ Aged 32 years. Good health until the present illness, always fond of sports. Married. One child; labor normal. Miscarriage one year ago. Trouble dates from miscarriage. Considerable hemorrhage was present for a time after the miscarriage. This finally ceased for a time but recurred, and was accompanied by purulent leukorrhea. Examination of the cervix showed it to be the seat of an elliptical ulceration. The tuberculous character of the cervical lesion was not recognized until after curettage of the uterus and amputation of the cervix. Histologic examination of the excised portions showed tuberculosis. Tubercle bacilli were demonstrated by staining methods. Recovery after the operation was normal. Apparently no tuberculosis of the other sexual organs or other portions of the body was present. The patient's husband had died of typhoid fever, and had always been healthy. Primary case.

Peham.⁶⁴ This patient was a nullipara 30 years of age. The chief symptom was progressively increasing purulent, and at times blood streaked, leukorrhea. Examination showed that the anterior cervical lip was the seat of an ulcerative lesion, which was suggestive of carci-

noma. A piece of the ulcer was excised for microscopic examination, which revealed its true character. Tubercle bacilli were demonstrated.

In the discussion of Peham's case, Fabricius stated that he had three cases of tuberculosis of the cervix.

Case 1. A young girl who had introduced a hair pin into the rectum. This perforated the rectovaginal septum and punctured the cervix. At the point of puncture on the cervix a tuberculosis developed. The diagnosis was confirmed by histologic examination. The girl died nine months later of tuberculous meningitis.

Case 2. The patient was a middle aged corpulent woman, who presented herself, suffering from profuse purulent, and at times blood stained, leukorrhea. Examination showed the cervix to be the seat of a necrotic, sloughing tumor-like mass, which was thought to be a carcinoma. Histologic examination of the tissue, however, proved the condition to be tuberculosis.

Case 3. The cervix in this case was found to be enlarged, indurated, and extremely hard. Histologically the condition was found to be tuberculosis. Details of this case are not given. It is of interest chiefly on account of the hardness of the lesion.

Santi.⁶⁵ This patient was 23 years of age, married, and had two children. The previous history showed that she had suffered from pleurisy some time prior to her present illness. She had also been operated upon for a peritonitis, probably of tuberculous origin. For some time there had been symptoms of Pott's disease. The only symptoms referable to the cervix were discharge and occasional irregular bleeding. Examination of the cervix showed it to be the seat of an irregular growth. Trachelectomy was performed and the tuberculous character of the lesion verified by histologic examination, the microscope revealing chronic inflammatory changes, numerous tubercles, many of which contained giant cells, and the usual typical appearance of tuberculosis in this locality. One histologic peculiarity was that, at some points, the squamous epithelium over the papilla had formed into masses more or less suggestive of syncytial cells. No tubercle bacilli were demonstrated.

Kromer.²⁰ A case of cervical tuberculosis, the only other focus of the disease being a patch of lupus on the left buttock. In this instance the chief seat of the disease was the external os, but there were tubercles in the serosa and muscularis of the tubes and uterus. She had had tuberculous peritonitis some years previously.

Deletrez.⁶⁶ The patient, aged 21 years. A cauliflower growth was present on the portio, which caused a suspicion of carcinoma, but the

microscope proved it to be tuberculous. The body of the uterus presented numerous small granulations separate from one another. Toward the cervix these became papillary in character. The mucosa here was reddened. The diagnosis was confirmed by histologic examination. The patient was in excellent health six months after a total vaginal hysterectomy. The author believes this to be a primary case. He calls attention to the fact that the ulcerative and miliary forms are usually secondary, but all recorded cases of primary lesions were of the hypertrophic variety.*

Everling.⁶⁷ Patient, aged 25, had apparently primary tuberculosis of the portio. The villous or papillary appearance and friable character, discharges, and irregular bleeding suggested carcinoma and pan-hysterectomy, but biopsy showed the real condition and a high trachelectomy was considered sufficient. Recovery.

Von Franque.⁴² A negress, aged 21 years, had irregular menstruation. There was a lesion on the cervix, which resembled a chancroid. This had not caused symptoms or discomfort. Biopsy showed tuberculosis. The uterus and adnexa were apparently normal, therefore only a trachelectomy was performed. Histologic examination of the amputated cervix showed tuberculosis, but no tubercle bacilli or cheesy degeneration. No tubercle bacilli were demonstrated in any other part of the body.

Lewers.⁴⁴ This patient had "bronchitis for a number of years." She was a nullipara, 36 years of age, had a slight, whitish leukorrhea for years, metrorrhagia for 9 months, and recently the discharge had become effusive. Metrorrhagia usually occurred in the form of "spotting," following slight trauma. She had noticed pieces of "skin" from time to time in the blood stained intermenstrual leukorrhea. The periods were regular and there was no increase in duration or amount. The cervix was more patulous than usual, and a soft friable growth was felt in the cervical canal, extending as far up as the fingers could reach. This bled easily on touch. The uterus was normal. A diagnosis was made of carcinoma. Vaginal hysterectomy was performed. Recovery. The diagnosis was made by histologic examination. The patient was well 5 years after the operation. The cervical mucous membrane was involved as well as the portio.

Croft.⁶⁸ Patient, aged 26 years, had a family history of tuberculosis. A moderate amount of leukorrhea had been present for some time. The menstruation was always irregular. She had amenorrhea for nine months. The cervix was enlarged, softened, and friable, bled

* A careful study of the literature fails to confirm this statement.

easily, and there was a profuse mucopurulent discharge. The cervix felt roughened, the anterior lip was elongated, everted, and the raised portion coarsely papillary, the projections being of various sizes, some as large as a pea. The involvement was chiefly around the center of the portio. The uterus and adnexa were normal. Biopsy was performed and a diagnosis of tuberculosis was made. Hysterectomy. Recovery. Histological examination then showed involvement of the corporeal endometrium also.

Cullen.⁶⁹ Case 1. Autopsy specimen. The patient died of a general tuberculosis. The uterus measures 7 cm. in length, 4.5 cm. in breadth, and 4.5 cm. anteroposteriorly. In the vaginal fornix is an ulcer 1.5 cm. in diameter and 1 cm. in depth. This has a sharply defined margin and a smooth base, studded with minute yellowish dots, varying from a pin point to 1 mm. in diameter. The cervix measures 3 cm. in length and 2.5 cm. in diameter. There is a slight transverse laceration. The lips are red and congested, but present an intact surface. The outer surface of the cervix, 1 cm. from the os on both sides, presents a raised appearance, the tissue being whitish yellow, and showing an irregular, eaten out appearance; the ulcers vary from 1 to 3 cm. in diameter. On opening the cervix a cavity 1.5 cm. in diameter is found, which begins at a point 1.5 cm. above the external os. This contains densely necrotic material. Its walls are ragged, eaten out, and irregular. This tissue is yellowish, soft, and stands out in contrast to the injected uterine wall. The adnexa are also involved. The diagnosis was confirmed by histologic examination.

Case 2. Attempted vaginal hysterectomy for condylomata and tuberculosis of the cervix. The autopsy revealed tuberculosis of the endometrium, tubes, and ovaries. Miliary tuberculosis of the lungs and pleura. Tuberculous ulcer of the intestines. Tuberculosis of the spleen and kidneys, and solitary tubercles in the brain. The patient, aged 17 years, colored, had a family history of tuberculosis. Profuse, effusive leukorrhea, fever, etc. No cough. The cervix and surrounding vaginal vault were occupied by firm, smooth, polypoid elevations, lining an ulcerated cavity. These were pinkish in color. Biopsy was performed. Amputation of the cervix was followed by quite severe hemorrhage. Histologic diagnosis.

Driessen.⁷⁰ This case occurred in a woman who had been operated upon seven years before for a stricture of the rectum and had complained for some time of menorrhagia and mucopurulent discharge. The cervix was found enlarged and studded with many small ulcers, most numerous about the external os, and growing fewer towards the periphery. In the

cul de sac were small, red spots with yellowish centers. Vaginal hysterectomy. Histologic examination showed characteristic tuberculous changes.

Vitrac.⁴⁸ This patient was a woman, 21 years of age, who entered the service of Lannelongue and Bordeaux, complaining of pain in the lower abdomen and of leukorrhea. There was a history of tuberculosis and examination showed lesions at the apex of the left lung. There was a history of trauma of the genital organs, which was followed by bleeding and dysuria. The cervix was enlarged and the seat of a vegetative outgrowth about the size of a walnut. This was elastic, yielding to the touch. The surface of the portio not involved in the papillomatous growths was reddened and inflamed. The uterus was small and adnexa adherent. Biopsy was performed and the diagnosis of tuberculosis arrived at. A vaginal hysterectomy was performed and the diagnosis confirmed by further histologic examination and also by animal inoculation. Operative recovery.

Frank.²³ This patient gave a previous history of a tuberculous bone disease, involving the metacarpal bone and one phalanx of the middle finger, which was excised and apparently cured 6 years ago. This patient had never suffered any pain and had sought relief for dysmenorrhea. Examination at that time showed the portio vaginalis to be enlarged and somewhat mushroom shaped. Numerous vesicles and nodules were present, most numerous about the external os. The papillary masses bled readily. The case was diagnosed clinically as a malignant neoplasm. Biopsy showed the true character of the lesion. Following the diagnostic excision there was considerable hemorrhage, which required firm tamponage. Hysterectomy was performed; the tubes were normal. Recovery. Frank believes the infection in this case resulted from contamination by the hands or by soiled linen.

Beyea.¹⁴ A patient, aged 23 years, with a negative family history. She had irregular menstruation, dysmenorrhea, and more or less leukorrhea, at times purulent, for 3 years. The portio vaginalis was enlarged to twice its normal size and was the seat of an extensive ulcer, which involved the external os. This ulcer was bright red and bled easily. Trachelectomy and bilateral salpingo-oöphorectomy was performed, and the diagnosis made by the microscope. Tubercle bacilli were demonstrated by staining methods in some of the sections. A tuberculous salpingitis was also present. The patient was in good health 16 months after the operation.

Baudet.⁷¹ This patient was 51 years of age and presented herself, exhibiting symptoms suggestive of carcinoma of the cervix. Examination showed the cervix to be the seat of an extensive papilla-like growth,

which also involved the adjacent anterior vaginal wall. The tumor-like masses were moderately friable, and were covered with a profuse malodorous discharge. The excised tissue presented the usual histologic picture of tuberculosis in this area. A careful examination of the lungs failed to reveal any evidence of tuberculosis. This was of the type described by the French writers as the pseudoneoplastic. Primary case.

Young.⁷² This patient's family history was negative for tuberculosis. She was a tripara. The last child was born 2½ years ago. They are all healthy. The patient was healthy until six months ago, when the periods began to become more profuse and of longer duration than usual, and for the last five weeks thick yellowish non-odorous leukorrhea has been present. Constant pain in the lower abdomen and sacral region has been present for a similar period. There was no enlargement of the inguinal glands. The cervix was indurated and greatly enlarged. Its surface was uneven and ulcerated in places, and in other places nodular and papillary, but not friable. The uterus was freely movable. There was a suspicion of malignancy. Vaginal hysterectomy was performed. The patient was examined six months after operation and was found healthy. The diagnosis rests upon the histologic evidence.

Nebesky.⁷³ This patient was a woman aged 33 years. A careful examination failed to reveal any foci of tuberculosis other than those in the genital tract. The cervix was the seat of an advanced tuberculosis; the endometrium of the body of the uterus and the tubes were also involved, but Nebesky believes these were secondary to the cervical lesion, as the pathologic changes became progressively more pronounced as the cervix was approached. The tubes were but mildly affected. Panhysterectomy and bilateral salpingo-oöphorectomy were performed and resulted in a cure.

Matthews.⁷⁴ This patient was single, 22 years of age, negress, never pregnant. First menstruated at 15 years, one day's duration and scant, regular. Later, every three weeks. Dysmenorrhea for three years, and occasionally colicky pains in the hypogastric region. Recently profuse mucopurulent leukorrhea, and often blood stained, has been present. Examination showed the cervix enlarged to twice its normal size, and the seat of a worm-eaten bleeding ulcer. The right adnexa were enlarged, adherent, and the base of the broad ligament was thickened. The fundus was enlarged and partially adherent. A vaginal hysterectomy, bilateral salpingo-oöphorectomy and excision of the upper portion of the vagina were performed. The patient was discharged from the hospital as cured. Histologic examination showed the cervix to be the seat of a diffuse tuberculosis, numerous typical tubercles, many of them cheesy, being

found. No record was made of the demonstration of tubercle bacilli nor was the vaginal lesion reported upon, but it was evidently a direct extension from the cervix.

Buscarlet.⁷⁵ 26 years of age. Family history of tuberculosis. Pulmonary tuberculosis was present. Complained of pain in the vagina and a profuse, thick, foul leukorrhea. Examination showed the cervix the seat of a friable granular growth, and covered with mucopurulent discharge. Death occurred from the pulmonary lesions. Autopsy showed tuberculosis also present in the tubes, ovaries, and body of the uterus.

Chaton.⁴ Family history of tuberculosis. Entered the Saint Joseph Hospital with a diagnosis of uterine prolapse. The cervix was hypertrophied. The suspected area was friable and ulcerated and whitish on section, and here and there caseous areas were present. The adnexa were involved. Diagnosis confirmed by histologic and inoculation methods. The lesion evidently began as an interstitial cervical tuberculosis.

Galabrin.⁷⁶ The author merely mentions during the course of a discussion a case of tuberculosis of the cervix, which was mistaken for carcinoma. The correct etiology of the condition was discovered only upon histologic examination.

Bouilly.⁴¹ The patient was 26 years of age and gave a family history of tuberculosis. Suffered a cervical laceration during delivery. On the posterior cervical lip, at the seat of the laceration, slowly developing ulcer appeared. This was excised, resulting in recovery. The ultimate outcome of the case is not stated. The diagnosis is founded upon histologic examination.

Bouffe.⁵² The patient was 26 years of age, and gave a family history of tuberculosis. Married and her husband had suffered from a tuberculous epididymis. She complained of pain in the vagina and purulent leukorrhea. Examination revealed an ulcer occupying the posterior cervical lip, the base and edges of which were moderately firm and presented a somewhat cicatricial appearance. Palliative treatment was followed by improvement. Tubercle bacilli were demonstrated from the ulcer.

Reverdin.⁷⁷ Case 1. The patient was 30 years of age and presented a personal and family history of tuberculosis. For three months had been suffering from irregular and moderately profuse hemorrhages, chiefly metrorrhagic in type. Examination showed an ulcer on the vaginal cervix, and the body of the uterus and adnexa also involved. On account of the extensive primary involvement and the poor general condition of

the woman, no radical treatment was employed. Death occurred in 3 months.

Case 2. This patient was 23 years of age and gave a family history of tuberculosis. Pulmonary tuberculosis was present. For some time the patient had suffered from pain in the lower abdomen and metrorrhagia. The cervix was enlarged, and on the anterior lip was a reddened ulceration. This was treated with silver nitrate and tincture of iodine, and is said to have disappeared. The body of the uterus was also enlarged and probably involved in the tuberculous process.

Nanard.⁴³ Pulmonary and intestinal tuberculosis was present. Death occurred. At autopsy the anterior cervical lip was found to be the seat of an extensive ulcer, which involved the external os. The tubes and uterus were diseased. The diagnosis was confirmed by histologic examination.

Lepetit.¹⁸ This was an autopsy specimen, the subject having died of a tuberculous peritonitis and other complications, the lungs also being involved. The cervix was the seat of an ulcer, which possessed irregular edges and a necrotic base. The diagnosis was confirmed by histologic examination. The fallopian tubes and uterus were also involved.

Cornil.^{50, 89} Case 1. The patient presented an ulcer on the cervix. On histologic examination this was found to contain tubercles and giant cells and other evidence of tuberculosis. This is one of the earliest if not the earliest case verified by histologic examination.

Case 2. This patient was a middle aged woman, whose chief symptoms were discharge and irregular bleeding. Examination showed the cervix increased in size and indurated; numerous vegetative outgrowths were present. The diagnosis, sarcoma of the cervix, was made, and a panhysterectomy performed. The correct diagnosis was arrived at by histologic examination.

Uhland.⁷⁸ This patient was 20 years of age and presented a family history of tuberculosis. The symptoms referable to the cervical condition were leukorrhea and irregular bleeding of the metrorrhagic type. Death occurred from a tuberculous peritonitis. Autopsy showed the cervix to be the seat of a tuberculosis; the corporeal endometrium and myometrium and adnexa were also involved.

Laboulbene.⁷⁹ A patient, 20 odd years of age, died of pulmonary tuberculosis. At autopsy the cervix was found to be the seat of an irregular ulcer.

Parrot.⁸⁰ The patient was an infant that had suffered from a general tuberculosis, pulmonary, intestinal, meningeal, renal, etc. The cervix

was the seat of numerous small outgrowths which also involved the adjacent vagina.

Reclus.⁸¹ The patient was about 30 years of age. She was pale and anemic. There was a fistula in ano, probably tuberculous in origin, present. The cervix was enlarged and the seat of numerous small semi-transparent granulation-like outgrowths. The lesions were small and superficial and were treated by cauterization with the actual cautery and the application of the tincture of iodine. Recovery.

Pollosson and Violet.⁴⁰ This patient was 45 years of age and gave a family history of tuberculosis. Pulmonary tuberculosis was present. The cervix was the seat of a lesion which resembled carcinoma, involving chiefly the anterior lip. A vagino-abdominal hysterectomy was performed, and upon histologic examination of the cervix the true character of the condition was discovered. Adnexal lesions were also present. Operative recovery.

Raynaud.¹ Case 1. Death from pulmonary tuberculosis. Autopsy showed a small tumor springing from the posterior cervical lip. A doubtful case.

Case 2. The patient was 37 years of age and suffered from pulmonary and meningeal tuberculosis. There was a moderate sized necrotic ulcer on the portio. Vaginitis and adnexal lesions were present. The case is without histologic or bacteriologic verification.

Haby.⁸² The patient was 21 years of age and had always been delicate. No pulmonary lesions were present. Profuse offensive leukorrhea was present. A speculum introduced into the vagina showed the cervix to be the seat of a papillomatous, friable, easily bleeding, tumor-like outgrowth, covered with a glairy discharge, which was clinically diagnosed as a sarcoma. Biopsy and curettage, however, showed the true nature of the lesion. Tubercle bacilli were demonstrated.

Hofbauer.⁴⁹ The patient was 26 years of age and presented a family history of tuberculosis. She was a multipara and the labors had been normal. The lungs and heart were normal. Springing from the cervix was a tumor-like outgrowth. A diagnosis of a cervical neoplasm was made and a vaginal hysterectomy performed. Histologic examination showed, however, that the uterus and cervix were the seat of a tuberculosis.

Thiercelin.²⁶ The patient was 24 years of age and gave a negative family history of tuberculosis. The chief symptoms referable to the genital tract were menorrhagia and discharge. The temperature was 40° C., and there was pain in the lower abdomen. Death resulted from advanced pulmonary tuberculosis, involvements of the fallopian tubes,

pericardium, lungs, and body of the uterus. The cervix was the seat of a deep ulcer, the walls of which were soft, spongy and friable. The lesions had apparently extended from the external os. The adjacent vagina was also involved. The diagnosis was verified by histologic examination. The disease followed a miscarriage, and the pulmonary symptoms developed subsequently.

Meyer.³³ The patient was 30 years of age and had suffered from lupus. Metrorrhagia and leukorrhea were the chief symptoms referable to the genital tract. Examination showed that the cervix was considerably enlarged, reddened and indurated. A portion of the suspected tissue examined histologically showed giant cells and other evidences of tuberculosis.

Godard.⁸³ The patient was 23 years of age and was admitted to the service of Louis at the Hotel Dieu, where she died of a wide spread tuberculosis, the meninges, lungs, intestines, and other organs being involved. It had been noticed before death that the cervix was reddened; it was subsequently found to be the seat of a caseous ulcer. Histologic examination by Corvisart.

Cotte.³⁶ The patient was an anemic woman 23 years of age. The family history was negative for tuberculosis. There had been irregular bleeding and discharge for some months. The cervix was enlarged, and, surrounding the os, was an area somewhat resembling eversion. The adnexa were also involved, but the uterus was small and sclerotic. Histologic examination of the suspected cervical lesion showed this to be a tuberculous ulceration.

Schutt.³² The patient died when 33 years of age of a general tuberculosis. An early pregnancy was found, and the decidua and even, in some areas, the myometrium, was the seat of caseous lesions. The cervical mucosa was also involved. It was in some areas thickened and reddened and, on histologic examination, evidence of a tuberculous cervicitis was found. Schutt states that the inflammation of the cervix was catarrhal in type. The surface and granular epithelium presented characteristic changes, caseation in or near the gland, and tubercle bacilli.

Sippel.³⁵ The patient was 31 years of age and complained of leukorrhea and irregular bleeding. On inspection, the cervix was found to be reddened and congested and to be the seat of an ulcer, the edges of which were firm to the touch. Biopsy was performed and a typical histologic picture of tuberculosis found. The lungs and fallopian tubes were also tuberculous.

Menetrier.²⁸ The patient was 24 years of age and died of pulmonary tuberculosis under the care of Jaccoud. The body of the uterus

was enlarged. The cervix was the seat of an extensive ulceration, the surface of which was vascular and friable. Considerable caseous material was present. Tubercle bacilli were demonstrated. The fallopian tubes were also involved.

Mayor.⁸⁴ This was a patient suffering from pulmonary tuberculosis in the service of Sireday. A whitish, granular ulceration was present on the anterior lip of the cervix. A pelvic peritonitis, involving the uterus and appendages, was also present. Death occurred and an autopsy was performed. Verification of the etiology of the cervical lesions was obtained by histologic examination.

Adenot.⁸⁵ The patient was 17 years of age and admitted to the service of Poncet suffering from tuberculous peritonitis. A laparotomy was performed and was followed by death. At autopsy the lungs were found to be involved. The mucosa of the cervix was reddened and a small lenticular shaped ulcer was present. Histologic verification of the diagnosis was made.

Boldt.⁸⁶ The patient had a tuberculous pleurisy and an ulceration upon the cervix. A curettage was performed and later a panhysterectomy. Death occurred six hours later. Histologic verification of the diagnosis.

Cheron.⁸⁷ The patient was 24 years of age, and entered the Saint-Lazare hospital suffering from pulmonary tuberculosis. An ulcer was found in the cervix, which somewhat resembled an ectropion. This was chronic looking in appearance, and gave no marked symptoms.

Chiarabba.⁸⁸ Menstruated at 16 years. At 24 years the menstruation disappeared. The chief local symptom was discharge. The body of the uterus was enlarged and the cervix was the seat of an ulcer, the base of which was granular in appearance. The diagnosis was verified by histologic examination. The patient also had a tuberculous peritonitis and involvement of the uterus, tubes, and labia majora and minora.

Fernet.⁹⁰ This patient was 27 years of age and suffered from pulmonary tuberculosis. The cervix was the seat of a small granular erosion, which under local treatment disappeared. Tubercle bacilli were demonstrated in the vaginal discharge. A doubtful case.

Frerichs.⁹¹ The patient was 25 years of age and presented an ulceration on the mucosa of the cervix, which extended some distance into the canal. The fallopian tubes, uterus and pericardium were involved and also the kidney, intestines and other areas.

Gummert.⁹² The patient was a nullipara, 29 years of age, who suffered from a purulent leukorrhea and amenorrhea. There was a circular ulcer at the external os, and on the surface of the portio were numerous

small, whitish elevations about the size of millet seeds. Biopsy confirmed the diagnosis of tuberculosis and a vagino-abdominal hysterectomy was performed. Adnexitis was present.

Gottschalk.⁹³ The patient was a virgin, 32 years of age, who presented a previous history of tuberculosis. Pains in the lower abdomen and a profuse, thick, offensive discharge were present. Examination showed a papillary mass originating from the cervix. A vaginal hysterectomy was performed with an excellent result. Tuberculosis of the endometrium and tubes was present. Histologic verification of the diagnosis.

Haidenthaler.⁹⁴ The patient was 28 years of age and presented a previous history of tuberculosis. An ulcer was present on the anterior cervical lip. This was curetted, without marked benefit. The patient subsequently died, and autopsy showed pulmonary and renal tuberculosis and a tuberculous salpingitis. This diagnosis of the cervical lesion was verified by histologic examination.

Holmes.⁹⁵ The subject was a cachectic woman, who died of a general tuberculosis, the lungs, peritoneum, intestines, and adnexa being involved. A miliary tuberculosis is said to have been present in the cervix. A doubtful case.

Knauer.⁹⁶ The specimen was presented before the Vienna Medical Society. The disease was of the ulcerative type, the vaginal portion of the cervix being the seat of a lesion. A panhysterectomy had been performed.

Liouville.⁹⁷ The cervix was the seat of a tuberculous lesion and the fallopian tubes were also involved. The case is extremely doubtful, despite the fact that the diagnosis was verified by Lebert.

Rivilliod.⁹⁸ The subject was an aged woman, who died of pulmonary and intestinal tuberculosis. The uterus and adnexa were the seat of inflammatory lesions. An ulcer was present in the cervix.

Richelot.⁹⁹ Case 1. The patient suffered from pulmonary tuberculosis. An ulcer was present in the cervix, and a hysterectomy was performed. The diagnosis was verified by histologic examination. This case is not reported by Richelot in detail.

Case 2. The patient was a nullipara. Examination showed the cervix enlarged and the seat of an ulcerative lesion. Biopsy was performed and the diagnosis of tuberculosis made. Hysterectomy was then performed, and examination of the specimen thus obtained showed involvement of the cervical canal. The corporeal endometrium, according to Cornil, was the seat of a non-tuberculous endometritis. He, however, thinks that the cervical tuberculosis was the result of a hematogenic infection.

Von Hauschka.¹⁰⁰ The patient was at the cancer age and presented symptoms suggestive of this condition. The cervix was enlarged and covered with partially necrotic papillary outgrowths, which were bathed in an offensive discharge. A vaginal hysterectomy was performed and the diagnosis arrived at by histologic examination. Tuberculosis was also present in the body of the uterus and in the fallopian tubes.

Schultze.¹⁰¹ The patient presented a previous history of tuberculosis. Leukorrhea was the chief local symptom. The mucosa of the cervix was irregular, reddened, and bathed in an offensive discharge. Biopsy was performed and the diagnosis of tuberculosis made. Vaginal hysterectomy was then performed. Bacteriologic and histologic examination confirmed the diagnosis of the cervical condition.

Späth.⁶ The patient was 26 years of age and gave a previous history of tuberculosis. The lungs, the body of the uterus, were involved. The cervix was the seat of an ulcerative lesion. The base of the ulcer had a granular appearance.

Thompson.¹⁰² Hypoplasia of the lower genital tract was present in a young girl. The cervix was the seat of numerous small semitranslucent elevations which were thought to be miliary tubercles. A pelvic peritonitis was present. In this case small retention cysts were probably mistaken for miliary tubercles, as has previously been done by Lisfranc¹⁰³ and Thiry.¹⁰⁴

Walther.¹⁰⁵ The patient was 26 years of age. Amenorrhea was present. Leukorrhea had been present for some time. The body of the uterus was the seat of a tuberculosis. There was an ulcer on the cervix, which was covered with glairy discharge. The base of the ulcer was moderately soft. Biopsy was performed and the diagnosis of tuberculosis arrived at.

Weigert.¹⁰⁶ An aged woman suffering from pulmonary and peritoneal tuberculosis. An ulceration was present upon the vaginal cervix and had extended to the adjacent vagina. Clinical diagnosis only.

Winter.¹⁰⁷ The patient suffered from pulmonary and peritoneal tuberculosis. A tuberculous endometritis and salpingitis was also present. There was a necrotic ulceration on the portio vaginalis. The histologic examination confirmed the diagnosis.

Ducuing and Rigaud.¹⁰⁸ The patient was 33 years of age. She entered the service of Chamayou at the Hotel Dieu. Gave a previous history of tuberculosis. Bipara. Pulmonary tuberculosis. Irregular menstruation and profuse purulent leukorrhea were the chief symptoms referable to the genital tract. Examination shows the external os to be the seat of an irregular ulceration, affecting chiefly the right side of the

cervix. The cervix was increased in size. Biopsy revealed the true character of the lesion. Panhysterectomy was performed. Animal inoculation from the cervix produced tuberculosis. The patient recovered.

Williams.¹⁰⁹ Case 1. Aged 63 years, multipara; death from pulmonary tuberculosis. Autopsy showed advanced phthisis and tuberculous pelvic peritonitis. Uterus slightly enlarged. Anterior cervical lip hypertrophied and adherent to the adjacent vaginal wall. A number of ulcers were present. They were irregular, sharply cut, possessed slightly raised edges and a base studded with grayish semitransparent granulations. Extension to the adjacent vagina had occurred. The diagnosis was verified by histologic examination.

Case 2. Bipara, aged 36 years. Chief symptoms backache and profuse leukorrhea. These symptoms were of several months standing. Painful and scanty menstruation. The cervix was lacerated and felt indurated, and was reddened and the seat of an ulcer, the base of which was yellowish gray, with indurated and sharply cut edges.

This bled easily to touch. A caseous cast filled the ulcer, which, when removed, left a nodular bleeding base. Histologic verification of diagnosis. Palliative treatment, but patient still under treatment when report was made. Patient had some lung condition some time prior to the appearance of the genital symptoms, and was a delicate woman.

Maly.¹¹⁰ The patient was a single woman, 21 years of age. Pulmonary tuberculosis had been present for some time and she was weak and anemic. The chief symptom referable to the genital tract was leukorrhea, which was moderately profuse, offensive, and occasionally blood tinged. A pelvic examination showed the hymen unruptured and the portio vaginalis the seat of a papillary, fungus-like outgrowth, which was covered with discharge and which, on touch, was soft, friable, and bled easily. Hysterectomy was performed and the diagnosis verified by histologic examination.

Tate.¹¹¹ Aged 36 years. Nullipara, married. Had an operation for the removal of tuberculous glands of the neck 6 years ago. Had an attack of pelvic peritonitis three years ago. Dysmenorrhea for one year. Examination showed cervix enlarged and the cervical canal extended into a large cavity filled with a soft, friable growth. A portion of this was removed digitally, and histologic examination showed tuberculosis. The uterus was enlarged and the appendages involved. Vagino-abdominal hysterectomy and bilateral salpingo-oöphorectomy. The ulcer did not extend above the internal os, and the portio vaginalis was fairly normal. Recovery.

Tedenat.¹¹² The patient was a woman, 26 years of age, who had

been married three years, and had never been pregnant. Amenorrhea. The chief local symptom was discharge. The cervix was the seat of a polypoid vegetative outgrowth, which was moderately soft to the touch. The diagnosis of cancer was made clinically, and the correct etiology of the lesion was only determined by histologic examination. The lesions were cauterized and treated with formalin, with some improvement.

Addisell.¹¹³ The author exhibited a specimen of a uterus from a tuberculous woman, in which tuberculosis was present and was histologically demonstrated as extending from the cervix to the fundus.

Bender.⁶³ The patient, aged 34 years, entered the clinic September 25, 1911. The family history was negative for tuberculosis. There was a previous history of measles, scarlet fever, and articular rheumatism, and an acute pneumonia fourteen years ago. She was a tripara, the puerperium had been normal, and the children were healthy. The chief genital symptom was a profuse, purulent malodorous discharge. This had been present for four years, but of late had been increasing in amount. There was pain in the lumbar region. The kidneys were normal, as were the lungs. Examination revealed some tenderness over the lower abdomen. Pelvic examination showed the cervix enlarged and engorged with blood, reddish in color, and on the posterior lip was an irregular, granular, pinkish ulcer partially covered with exudate. The ulcer was moderately soft and friable. On account of the possibility of cancer, biopsy was performed, and when the character of the lesion was determined, a trachelectomy and dilatation and curettage was performed. Recovery was uneventful, and the patient was well 2 years later. The diagnosis was finally verified by histologic examination and animal inoculation.

Popow.¹¹⁴ The patient was a multipara, 39 years of age, who presented herself, suffering from a necrotic ulcer of the cervix. Macroscopically the lesion was suggestive of cancer, and biopsy was performed. On account of the advanced character of the lesion and involvement of the corporeal portion of the uterus and also of the adnexa, a vaginal hysterectomy was performed. In addition to the cervical lesion, there was a tuberculous focus in the anterior uterine wall near the left cornu. Tuberculous salpingitis and endometritis was also present. Histologic verification.

Stone¹¹⁵ merely mentions a case operated upon by Dr. Cole. Stone states that he examined the specimen and that there was no tuberculosis found in any other portion of the genital tract or any history or physical signs of tuberculosis in any other portion of the body. The patient's husband was a strong healthy man, and there was no tuberculous family

history. The source of the infection could not be determined, but Stone states that it was without doubt a primary tuberculosis of the cervix.

Nicolo.¹¹⁶ Case 1. The patient was 24 years of age. Menstruated first at 14 years. Was always regular, but scant. She was married at 18 years. Had suffered from cough and other symptoms of pulmonary tuberculosis for some time. The chief symptoms referable to the genitalia were discharge and bleeding. The bleeding was of the metrorrhagic type and often followed slight trauma, such as coitus, etc. The discharge was purulent and frequently blood stained. Examination showed a fungoid, ulcerating mass, occupying the position of the cervix. The uterus was antiflexed and movable. Operation—Recovery. Histologic verification of diagnosis.

Case 2. The patient was a married woman, 40 years of age, who had had a number of children. She had pulmonary and laryngeal tuberculosis, and gave a history of lupus. The genital symptoms were suggestive of carcinoma—purulent, frequently blood streaked discharge, and irregular bleeding, especially following trauma. Examination showed a fungoid, ulcerating, friable mass originating from the cervix. Histologic verification of the diagnosis.

Kynoch.¹¹⁷ The patient was a married woman of 45 years of age, who had a family history of tuberculosis. For 3 months there had been irregular hemorrhages per vagina. Pelvic examination showed the external genitalia and vagina normal. The portio vaginalis was normal in appearance and the os patulous. The cervical canal, especially the anterior surface, was the seat of an eroded lesion. Many papillary outgrowths were present. These were stated not to have been friable, but bleeding followed manipulation. Biopsy was performed, followed by a vaginal hysterectomy. The diagnosis rests upon histologic verification. A tuberculous endometrium was also present.

Rossle.¹¹⁸ Autopsy case. Eighty-seven years, tuberculosis of the lungs, fundus of the uterus, and anterior commissure. An ulcerative tuberculous lesion was present in the cervix.

Moore.¹¹⁹ Age 27; married; negative family history; husband sound; nullipara; normal menstruation. For four weeks observed spotting after trauma. Diagnosis, cancer. Correct diagnosis made by biopsy. Vaginal hysterectomy. Recovery, but considerable foul leukorrhea and induration of vault of vagina fifteen months later. Histologic examination showed tuberculosis of tubes, fundus of uterus, and cervix, the oldest lesion being in the tubes. In the uterus and cervix the tuberculosis is limited to the mucosa. This case was of the miliary type.

For additional cases of tuberculosis of the cervix the reader is referred to the chapter dealing with lesions of the vagina.

TUBERCULOSIS OF THE BODY OF THE UTERUS

Tuberculosis of the uterus may occur as an endometritis, a myometritis, or a perimetritis, or combinations of these lesions may be present. By far the most frequent structure of the uterus to be attacked by this infection is the corporeal endometrium. Infection of the endometrium is the second most frequent site for genital tuberculosis.

Endometritis.—Like other forms of genital tuberculosis, endometritis is almost always secondary to tuberculosis elsewhere in the body. Gördeler,¹²⁰ in a series of 4,620 postmortems, observed one case of apparently primary tuberculous endometritis, that occurred in a woman 68 years of age. Our experience points to the fallopian tubes as the source of infection in the large majority of lesions of this locality. A study of our cases has shown that in not a single instance in our series has the endometrium been involved without a concomitant infection of the tubes. Furthermore, our cases seem to show that the tubes harbor the primary genital lesion, and that from them the disease spreads as a descending infection, generally by continuity, to the endometrium of the body of the uterus. Contamination of the endometrium by leakage of the infected tubal contents through the intramural portion of the fallopian tube doubtless also accounts for a certain percentage of cases of tuberculous endometritis. The fact that, in a definite proportion of specimens, only the endometrium in the immediate neighborhood of the uterine end of the tube has been involved, the lower portion of mucosa of the body of the uterus being normal, is significant. This is especially likely to be the case in early cases, for, as the disease advances, the entire mucosa often becomes invaded. As in endometritis, the result of organisms other than tubercle bacilli, however, the entire mucosa is not as a rule uniformly attacked, irregular areas of well defined inflammation being scattered with other areas either less inflamed, or even normal endometrium. When, however, an endometritis is present, the mucosa in the cornua of the uterus is nearly always invaded, and usually the seat of the more advanced inflammation.

Numerous authorities have observed tuberculous endometritis without tubal involvement. As has been stated, this has not occurred in any of the cases comprising our series, and it is a generally accepted fact that, if the endometrium is the seat of a tuberculosis, the tubes are

involved in the great majority of cases. This is an important point to be considered in the treatment of genital tuberculosis. In other words, where a tuberculous endometritis is present, the tubes are also involved in the large proportion of cases, and this fact should be taken into consideration in the treatment of the disease, as the endometritis cannot be cured if constant reinfection is occurring from above. In at least two cases of our series the chief symptom was leukorrhea, the symptoms resulting from the tubal lesion being of minor subjective importance as compared with those arising from the uterus.

Tuberculous endometritis may be of either the (1) miliary, or (2) caseous or ulcerative variety, the former being by far the most frequent, in the proportion of 4 to 1 in our series. In this variety macroscopic lesions are not always present, although thickening and reddening of the endometrium are often observed. Tubercles can be seen in some specimens with the naked eye, but in many they are inconspicuous or even undiscernible except with the microscope. Characteristic lesions, although not by any means always present in the tubes, are, however, much more frequent than in the interior of the uterus. In the caseous variety the etiology of the lesion can generally be determined by the macroscopic appearance of the specimen. The thickening and reddening of the mucosa, with perhaps here and there actual ulcer formation, and the characteristic cheesy particles adherent to the endometrium should always at least suggest this form of infection.

As in other forms of endometritis, more or less involvement of the underlying myometrium usually occurs, and in the advanced cases, especially of the caseous variety, the uterus is often enlarged, a well marked myometritis being present. On the other hand, in early cases, especially of the mild type, the uterus is often normal in appearance, and only upon close histologic examination will any involvement of the myometrium be found, and only then in the muscle fibers immediately underlying the infected endometrium. Tubercles may, of course, be present upon the peritoneal surface in any of the varieties of uterine tuberculosis. One or two cases have been observed in which the myometrium was the only portion of the uterus involved. Such instances are, however, of extreme rarity and may be regarded as pathologic entities. As has been stated, a well defined perimetritis is a frequent lesion and a common accompaniment of tuberculous salpingitis. Kromer²⁰ has recorded an unusual case, in which a tuberculous process had perforated the posterior uterine wall, forming a communication between it and Douglas' *cul de sac*.

As in tuberculosis of the tubes, no age is immune. The disease, how-

ever, most frequently occurs during the active sexual life of the individual.

Symptoms.—The symptoms resulting from a tuberculous endometritis are generally more or less masked by those produced by the accompanying salpingitis. Less frequently the converse is true. As infection of the endometrium is usually antedated by a similar infection of the tubes, a close analysis of the history of the case will usually show that symptoms resulting from disease of the latter structures have occurred before those directly attributed to the uterus. The symptoms resulting from the endometritis alone are in no way pathognomonic of tuberculosis, but are common to all forms of chronic endometrial infections of the uterine mucosa. Leukorrhea, pain or tenderness in the lower abdomen are perhaps the most frequent. The leukorrhea is not usually characteristic; in advanced cases of the caseous variety cheesy particles may be present in the discharge and, where observed, are always suggestive of this form of infection. The leukorrhea naturally varies markedly in different cases, but is usually moderately profuse, at first thin, in the latter stages becoming purulent, and in some instances, especially when ulcers are present in the uterine mucosa, blood stained. The presence of leukorrhea without evidence of infection of the lower genital tract, especially in the young and virginal, should suggest the likelihood of tuberculosis as an etiologic factor. In gonorrhea the discharge is chiefly cervical in origin. Tuberculosis exhibits a strong tendency to limit its downward spread to the internal os, so that the discharge in these cases is corporeal in origin, although naturally more or less mixed with the normal cervical mucus. The leukorrhea consists of secretions from the uterus and to a lesser extent from the cervical glands, epithelium débris, and leukocytes. In some instances cheesy particles consisting of tuberculous débris may be present. Tubercle bacilli are usually present in the discharge, but are often few in numbers and difficult to demonstrate. It would seem, however, that the examination of the discharge for tubercle bacilli, either by animal inoculation or by smear methods, or by both, in suspicious cases is a means of diagnosis which has not been fully taken advantage of by many observers.

Pain is by no means a constant or reliable symptom. Pain and tenderness in the region of the uterus are, however, suggestive of the occurrence of an endometritis. How much of the dysmenorrhea which these patients suffer from is due to an actual uterine involvement, how much to the usual accompanying adnexal lesions, is difficult to determine. Pulmonary tuberculosis itself often produces dysmenorrhea, and as

many of these patients are the incumbents of pulmonary lesions, this may account for some of the cases of this condition. Certain it is that cases of pelvic peritonitis of tuberculous origin nearly always suffer from dysmenorrhea, usually of the congestive type, the pains appearing some hours or days before the appearance of the flow, continuing for the first few days, and being of a dull, heavy aching character in the lower abdomen and lower lumbar and sacral region. Menstrual irregularities, both as to periodicity and amount of flow, are of frequent occurrence, but are probably more the result of the primary lesion or of the ovarian involvement than of the actual endometritis.

Diagnosis.—A positive diagnosis is practically impossible, unless tubercle bacilli can be demonstrated in the discharge or the tissue is examined histologically. The absence of evidence of other forms of infection, the presence of a tuberculosis in other parts of the body, extreme youth or virginity, are all suggestive of this form of tuberculosis. As has been stated, uterine involvement is usually secondary to adnexal lesions, so that much of what will be said regarding the latter condition applies to tuberculous endometritis.

Treatment.—All forms of local application are valueless in this variety of infection. Curettage, followed by the application of some bactericide, such as the tincture of iodine or formalin solution, or in severe cases, hysterectomy, are the two forms of treatment which offer the best hope of cure. Curettage alone is not indicated. The tubes are nearly always involved, and, unless an operation is directed towards them at the same sitting, an acute exacerbation of the salpingitis is likely to occur. For this reason curettage should immediately precede all operations for tuberculous salpingitis, but is usually contra-indicated under other circumstances. Vaporization has been employed by some operators. The introduction of live steam into the uterine cavity is not without danger. The author believes that the risks attending this form of treatment are greater than in curettage or even hysterectomy, and that the results are not so satisfactory. One of the chief disadvantages of vaporizing is the difficulty of actually controlling the steam and ascertaining the exact depths to which the tissues are being destroyed. The endometrium in these cases varies quite widely in thickness and what would be sufficient steam to boil off the mucosa in one case might only destroy the superficial layer in another.

Of prime importance in these cases is the treatment of the adnexitis, and the question of whether or not the uterus shall be removed depends largely upon the type of operation practiced upon the tubes and ovaries. When it is necessary to remove both ovaries, nothing is gained by the

conservation of the uterus. The actual condition of the uterus, whether enlarged, etc., must also be taken into consideration, as well as the age of the patient, the condition of the primary lesion, and many other points which will be considered under the treatment of tuberculous adnexitis. The author believes that in all cases, regardless of symptoms, a curettage and iodination of the uterus should precede all operations upon the adnexa in tuberculous cases.

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CHAPTER IX

TUBERCULOSIS OF THE FALLOPIAN TUBES AND OVARIES

Fallopian tubes and ovaries anatomically and symptomatically considered together—Predisposition—Routes of transmission—Histologic examination—Factors—Analysis of cases—Study of acute and chronic stages—Duration of acute stage—Characteristics of chronic stage—Other forms of infection—Tuberculin an aid to diagnosis—Differential diagnosis between tuberculous, gonococcal, and streptococcal pelvic inflammatory disease—Family history—Prognosis—Cases—Methods of treatment—Bibliography.

General Considerations.—Tuberculosis of the fallopian tubes is a comparatively frequent form of infection, whereas true tuberculosis of the ovaries is relatively infrequent. However, when tuberculosis of the tubes is present, a peri-oöphoritis is a common accompaniment. For this reason, and because the two organs are so closely associated, both anatomically and symptomatically, tuberculosis of these structures will be considered together.

Tuberculosis of the tube, like tuberculosis of the other parts of the genital tract, is usually secondary to a tuberculous focus elsewhere in the body, pulmonary tuberculosis being by far the most frequent seat of the primary disease. Next to the lungs, the peritoneum, osseous system, lymph glands, and intestines are perhaps the most frequent sites of the primary infection. In a series of thirty cases from the gynecological department of the University of Pennsylvania Hospital which have been studied, thirteen showed well marked pulmonary lesions. Of the thirteen, involvement of one lung was present in nine, and in the remainder both lungs were affected. In all the pulmonary lesions were quiescent, and in none was the disease advanced. The material from which these statistics were formulated was based upon operative cases only. It has not been our custom to operate upon patients in whom the pulmonary lesions are either acute or advanced, and for this reason the foregoing statistics are somewhat misleading.

Albrecht and Schlimpert,¹ in a series of autopsies on women, found that the primary source of the genital infection was as follows: lungs, 73 per cent; intestines, 20 per cent; bones, 4 per cent; peritoneum, 2 per cent.

The frequency with which the tubes are affected in tuberculous females has been analyzed in previous pages. In the series of postmortem records from the Henry Phipps Institute studied by the author these organs were found macroscopically diseased in about 7 per cent of cases. This closely corresponds with figures given by other observers. It should, however, be remembered in considering postmortem records that, as a rule, no histologic examination was made of the fallopian tubes, unless these structures presented macroscopic lesions. Williams² has very properly pointed out that occasionally histologic examinations reveal tuberculosis in macroscopically normal tubes, and this fact should be taken into consideration when considering the above figures. On the other hand, postmortem records, unless confirmed by histologic examinations, may be misleading, in that gonococcus or other pyogenic organism may produce pathological processes in the fallopian tubes of tuberculous women, and, unless the diagnosis of tuberculous salpingitis is confirmed by a microscopic examination, may cause a misconception regarding the type of the infection present.

As has been stated, tuberculosis of the tubes is, in the great majority of cases, secondary to tuberculosis in some other parts of the body. A few undoubted primary cases of tubal tuberculosis, however, have been recorded. Thus, Macnaughton-Jones³ records the history of three cases all of which he regards as primary in the tubes; two of these cases were unilateral, and in one both tubes were involved. Muller,⁴ Spanton,⁵ and Calzolari⁶ have also recorded the histories of cases of primary tuberculosis of the fallopian tubes. In Calzolari's case the disease was apparently transmitted by coitus from an infected husband. A negative ophthalmo-reaction was present subsequently to operation. Murphy⁷ relates a similar case. Purefoy⁸ states that 18 per cent of cases are primary. Our own studies have led us to believe that primary tuberculosis of the tubes is a rare condition, and that a careful study of the case will nearly always reveal a primary lesion, or the history will point to a previous infection by the tubercle bacillus.

In our series there were two cases in which the fallopian tubes were the only demonstrable seat of tuberculosis in the body; both these patients are well and show no evidence of infection since operation, which in one case took place three, and in the other five, years ago. Great care, however, should be exercised before a case is pronounced as primary, for, as is well known, latent foci may be present in other parts of the body which are undemonstrable by any known means, or the primary lesion may even have undergone a complete resolution. Not a few gynecologists and surgeons even deny the existence of primary genital tuberculosis. A

sufficient number of cases have, however, been studied at autopsy, and reported, to prove the existence of a primary infection, although it is certainly extremely rare. Furthermore, the existence of a primary infection of the genital tract has been demonstrated by animal experimentation. (See Chapter V.)

The tubes are the portion of the genital tract by far the most frequently attacked by tuberculosis. It is generally stated that the tubes are involved in 90 per cent of the cases of genital tuberculosis. In our laboratory, where all operative material is subjected to a routine histologic examination, the tubes have been found to be involved in all. It would seem, therefore, that 90 per cent is an under rather than an over estimate. Tuberculosis is nearly always for the genital tract primary in the tubes, and almost invariably secondary to tuberculosis elsewhere in the body. Mayer⁹ states that of 40 cases of tuberculosis in the abdomen, in 21 the disease was situated in the adnexa, and in 19 was definitely peritoneal in origin.

Tuberculous salpingitis constitutes from 4 to 12 per cent of all tubal infections. This proportion varies somewhat in different clinics.

In the laboratory of gynecology of the University of Pennsylvania this form of infection was demonstrated in 7.3 per cent of all pelvic infection. Andrews¹⁰ places the proportion at 1 to 3 per cent, Menge¹¹ at 9 to 10 per cent, Krönig¹² at 7 to 8 per cent, Pankow¹³ at 22 per cent, Heynemann¹⁴ at 11.7 per cent. Hurden¹⁵ reports that, of 1,001 cases of salpingitis collected from the Johns Hopkins Hospital Reports, 109 were tuberculous. Williams,² from the obstetrical department of the same institute, reports 4 per cent of all cases of salpingitis due to the tubercle bacillus.

The ovaries are comparatively rarely the seat of a true tuberculous oöphoritis, although peri-oöphoritis in the presence of tuberculous salpingitis is the rule rather than the exception. In our series of 31 cases, true oöphoritis was present in 4 cases, peri-oöphoritis in 7, while of the remaining 20, 5 showed well marked retention cysts. It is difficult to account for the normal structure of such a large proportion of ovaries from cases of tuberculous salpingitis, especially when it is considered that the mucosa of the tube is practically always involved. The result is the formation of considerable irritating secretion, which is poured out in the peritoneal cavity, as instanced by the adhesions found about these tubes. Another factor which would seem to favor the infection of the ovaries is that in tuberculous salpingitis, the abdominal ostium exhibits a marked tendency to remain patulous, thereby offering an opening for the escape of the tubal contents, which drip down over the ovaries inter-

mittently, often for prolonged periods. Even if the intact surface of the ovary were able to withstand the infection thus brought in contact with its surface, the normal rupturing of graafian follicles would, it might be thought, offer an avenue for infection. Furthermore, the fact that the infecting microorganisms in tuberculous salpingitis are often conveyed to the tubes by the blood or lymph stream and the close anatomical relationship of the blood supply to the tubes and the ovaries would appear to favor infection of the latter. Practically, however, the ovaries are comparatively rarely infected, much less frequently than in pelvic infection from the gonococcus or other pyogenic organisms. It would seem, therefore, that the ovaries must possess some inherent immunity to this form of infection. The fact that the ovaries are involved in a relatively small proportion of cases is of extreme importance when considering the surgical treatment of tuberculous pelvic inflammatory disease. When actual involvement of the ovarian stroma occurs, it is usually the result of infection gaining access to the ovaries through a ruptured follicle, the lesion often being an abscess of a corpus luteum. Horizontow¹⁶ believes that the stroma and cortical layer of the ovary are most frequently attacked. Todorsky¹⁷ has especially emphasized the gravity of ovarian complications, and believes that abscesses and even fistulas not infrequently follow.

As a result of the peri-oöphoritis which is so frequently present, retention cysts are often an accompaniment, and malposition of the ovaries due to adhesions and secondary edema is not uncommon. Martin has especially called attention to the hypertrophy of the ovaries occurring in these cases. Hypertrophy has not been frequent in our series. Primary tuberculosis of the ovaries is extremely rare, even more so than a similar infection of the tubes. Senni¹⁹ has, however, reported the history of such a case.

The question of predisposition towards tuberculosis of the genital tract and especially of the fallopian tubes is a subject which has promoted considerable study of recent years. As the disease is secondary in the large proportion of cases, a primary focus in some other part of the body is perhaps of chief importance. Preëxisting inflammation is undoubtedly also a predisposing factor. In tubal infection in general mixed infections are by no means uncommon. It is impossible in some cases to determine whether a gonococcal infection is superimposed upon a tuberculosis, or whether the reverse is the case; most authorities believe that the latter is the more frequent condition, and that once the tubal mucosa is altered by a gonococcal inflammation, an excellent soil for the development of

tuberculosis is prepared. In the Pathological Laboratory of Gynecology at the University of Pennsylvania 30 cases of tuberculosis of the tubes have been examined by the author. In 20 of these the history or histologic appearance of the specimen was sufficiently pronounced to cover this point, 6 of the 20 cases had apparently been preceded by a Neisserian infection. Owing to the fact that the bacteriologic tests have not been carried out in a routine manner in many of these cases, it is, however, impossible to definitely determine this point. Simmonds²⁰ was one of the first to point out the relationship between preëxisting inflammation and tuberculosis of the tubes. Saulman²¹ and Schuchardt²² have also emphasized this point.

Bandelier and Roepke²³ state that marked redundancy and folding of the plica of the tubal mucosa, stagnation of the tubal secretion, and poor blood supply are also predisposing factors. These latter causes, however, appear to the author to be somewhat theoretic and unproven. Trauma in rare instances may play a predisposing part in tuberculous infection, as it undoubtedly does in other parts of the body. The normal fallopian tubes, however, owing to their protected position, are rarely the subject of wounds or injuries from without. Whether or not heredity plays a predisposing part is difficult to determine. It is, however, doubtful. Sellheim²⁴ and Schiffmann²⁵ believe that hypoplasia of the genital tract favors the development of tuberculosis.

The age of the patient is undoubtedly an important factor, patients of certain ages apparently exhibiting a greater tendency to immunity to this type of infection than do others. Thus, women past the menopause are comparatively rarely attacked by this form of tuberculosis. Children are by no means immune. Bruning²⁶ has collected from the literature 44 cases of genital tuberculosis occurring in the young, to which he adds 2 of his own. In the majority of these the tubes were affected. Allaria²⁷ has analyzed 19 cases, all of which are reported as primary genital infections. Chaffey,²⁸ Silcock,²⁹ and Collingworth³⁰ have also recorded cases of tuberculous adnexitis occurring in children.

In our own series of 30 cases, the ages varied from 18 to 41, 2 being under 20 years, 15 between 20 and 30, 11 between 30 and 40, and 2 between 40 and 50. In Cummins'³¹ series of 21 cases the ages were as follows: 1 case between 10 and 15, 2 between 15 and 20, 7 between 20 and 25, 3 between 25 and 30, 4 between 30 and 35, 2 between 35 and 40, 1 between 40 and 45, 1 between 45 and 50. No age is immune. This disease is, however, most frequent during the active sexual life.

Symptoms.—The symptoms produced by tuberculous adnexitis are by no means characteristic, and differ to no marked degree from those

produced by other microorganisms. Pain, tenderness, sometimes slight enlargement of the lower abdomen, dysmenorrhea or other menstrual disturbances, sterility, dyspareunia, leukorrhea, constipation, nausea, vomiting, and evidences of a local peritonitis with fever, leukocytosis are among the most important. Hegar³² has divided the disease into two stages, one in which the pelvic organs can be identified by palpation, and one when they are matted together, forming an indistinguishable mass. For the purpose of study, however, the division into the acute and chronic stages seems more satisfactory. Patel³³ divides tubal lesions into four classes: where tubal lesions are the most prominent; where general peritonitis is the most prominent; where the ovarian lesion is the most prominent; where local complications are the most prominent. Under the last heading, Patel mentions peritonitis causing intestinal obstruction, spontaneous evacuation of an abscess into the intestine, ureter, bladder, vagina, uterus, or through the skin. Murphy³⁴ states that, unless there is a mixed infection, there is a strong tendency for the tube to stay open and that, while this condition exists, the course of the disease is similar to that of recurrent appendicitis—a period of relief or even good health followed by a sudden attack of pain, nausea, vomiting, local tenderness, fever and often a discernible effusion in the peritoneal cavity—but that, when the tube is closed, the recurrent type of symptoms is not present.

This is undoubtedly correct in theory. Practically, however, it seems probable that the closure of the distal end of the tube is often temporary and that, as a result of a lighting up of the infection, which produces an increase in the intratubal pressure, or of trauma, etc., formerly encapsulated pus or other secretion within the tube oozes out through the external abdominal ostium and sets up a fresh attack of pelvic peritonitis. The tube may subsequently become walled off or the abdominal ostium again close and result in an amelioration of the subjective symptoms. In other cases the tubal opening may become permanently closed and this, as Murphy states, results in more or less permanent lessening of the symptoms.

Evens³⁵ states that in a definite proportion of cases the previous history shows that there have been obscure attacks of peritonitis during girlhood, and that these are not infrequently followed by amenorrhea. In some cases the pelvic symptoms are preceded by those of a general peritonitis, often of the ascitic variety, which clears up and leaves behind a more or less well marked pelvic inflammatory disease; or the reverse may be the case. See chapter on General Tuberculous Peritonitis.

ACUTE STAGE.—During this stage, the patient exhibits the usual

symptoms of an acute pelvic peritonitis, the severity of the attacks varying with the individual cases and with the extent of the lesion and the previous duration of the disease. Thus, if the inflammatory processes are entirely walled off from the general peritoneal cavity, the symptoms are less marked than where an inflammatory tube is pouring forth an irritating secretion into the general peritoneal cavity. The subjective symptoms are similar to those of metritis, except that, where the tubes are involved, the pain and tenderness are more marked and are chiefly observed in the ovarian region. As tuberculous salpingitis is usually bilateral, pain is generally complained of on both sides of the uterus, the entire lower abdomen being tender. Bumm ³⁶ and Menge ³⁷ have very properly pointed out that tubal infections in general are more painful than are similar infections of the uterus. In the latter case the pain is often a marked symptom only at the menstrual periods. As a general rule, the onset of the symptoms, resulting from tuberculous adnexitis, is less marked and more insidious than in the ordinary forms of pelvic inflammatory disease.

The symptomatology of tuberculous adnexitis is difficult to define, because of the numerous structures which may be involved and which may in themselves produce special symptoms. Thus, if a tuberculous tube becomes adherent to the bladder, vesical irritability and other symptoms suggestive of a cystitis are likely to occur, whereas, if the tube be plastered against the rectum, painful defecation occurs and as a result constipation frequently follows. Cuturi,³⁸ as a result of experiments, states that when the bladder is in contact with a diseased tube, the former not infrequently shows a tuberculous cystitis at the point of contact. This may be a localized or a general cystitis. The author has observed two such cases. Unless this complication is borne in mind, the danger of a mistaken diagnosis, and considering the case one of renal tuberculosis, is not unlikely.

The onset of the disease is frequently marked by a chill, followed by nausea, vomiting, malaise, headache, elevation of temperature, and increased pulse rate. The temperature varies during the height of the disease from 100° to 105° F., 101° or 102.5° F. being perhaps the average evening rise. A blood count may show a moderate leukocytosis, which, however, is usually lower than in other forms of pelvic inflammatory disease or the white count may be normal. The appetite is lost and the usual symptoms of fever are present. The severity and duration of the attack vary markedly in different cases, and, as in gonococcal infections, the local symptoms are only a moderately reliable indicator of the extent of the disease. When pulmonary tuberculosis is present, the coughing

often markedly increases the pelvic pain. In some cases observed by the author this has been a distressing feature of the case.

An attempt has been made in the study of our cases to determine if, in tuberculous cases, the tubes were especially prone to be attacked at any particular stage of the menstrual cycle. The data which were obtained showed that cases might be attacked at any time, but that invasion of the tube appeared to be most frequent during the end of the second and the beginning of the third week following the beginning of the menstrual period, in this way differing from the gonococcal cases, in which extension to the tubes is prone to occur at or immediately following menstruation. One striking point brought out by our study was that, in the large proportion of our cases, 55 per cent plus, there was, or had shortly before been, an accentuation of the primary lesion in the lungs or elsewhere, just prior to the onset of the pelvic symptoms. In many cases the exacerbation of the primary lesion was slight, but careful questioning and examination showed that it had been present frequently.

The duration of the acute stage is uncertain, but as a rule this period lasts longer and is more resistant to palliative treatment than are the infections produced by the ordinary pyogenic organisms.

A general peritonitis may either precede or follow the tubal infection. The former class of cases will be considered in a subsequent chapter. The possibility of a general involvement of the peritoneal cavity following the tubal infection is a very real one. When the susceptibility of the peritoneum to the action of the tubercle bacillus is taken into consideration, and the vast number of tubercle bacilli which are present in the tubal secretion, much of which is being passed out into the peritoneal cavity, it is only remarkable that more cases of general tuberculous peritonitis do not result. Some cases run an acute or subacute course from the onset, rapidly developing a general peritonitis, and terminate fatally. No hard and fast rule can be laid down in this respect. As a general rule, however, it would seem that those cases which are depleted as a result of a primary focus of the disease at the time of onset of the pelvic symptoms offer less resistance and are more subject to a general peritonitis or a fatal termination than are those patients in whom the tubal involvement occurs early and who are in good general condition at the time of the beginning of the pelvic infection.

Examinations during the acute stage will show more or less distention of the abdomen, but, unless there is a general peritonitis, the enlargement tends to be limited to the lower portion. Tenderness and rigidity are especially marked over the affected areas. Smith³⁰ has called attention to the behavior of the abdominal cutaneous reflexes in acute condi-

tions within the abdomen and pelvis. The reflex is tested by striking the skin over the suspected area with some blunt instrument, often the blunt end of a pencil. Further reference to the subject of abdominal cutaneous reflexes may be found in the works of Pflasterer,⁴⁰ Müller and Seidelmann,⁴¹ Rosenbach,⁴² Van Gehuchten,⁴³ Strümpell,⁴⁴ Bodon,⁴⁵ Jamin,⁴⁶ Sicard,⁴⁷ and Rolleston.⁴⁸

A pelvic examination will reveal the uterus either normal in size or slightly enlarged, and induration can be felt in one or usually both vaginal fornices. The cervix is more or less fixed, and attempts to move it cause pain. This is a valuable diagnostic sign of all varieties of pelvic inflammatory disease. An inflammatory mass, varying according to the extent and character of the lesion, from slight thickening, induration or indistinct sense of resistance, to a tumor the size of a grape fruit or even larger, will be found occupying the region of the appendages. As a rule the lesions are not especially massive, except in advanced cases, when enormous masses composed of the inflammatory adnexa, omentum, intestines, and collections of serum or pus, may be present.

During the acute stage, owing to tenderness and tympanites, it is generally impossible accurately to outline the adnexal lesions.

CHRONIC STAGE.—The chronic stage can usually be traced to an acute attack, but occasionally the disease is subacute from the onset and follows an almost chronic course from the beginning. Indeed an insidious onset is more frequent in this than in any other variety of pelvic inflammatory disease. As in the acute stage, the symptoms vary markedly with the individual case. As a rule, to which many exceptions occur, the disease tends to run a prolonged chronic course, interspersed with acute or subacute attacks. Marked exacerbations are thought by some observers to occur only in the presence of mixed infection. The general health is as a rule poor, usually more so, perhaps, as a result of the primary lesion than actually caused by the pelvic trouble, although there is no certainty in this respect. These patients therefore are apt to be thin, losing weight, and often run a slight evening temperature, especially at the menstrual periods. As a result of adhesions, purulent material may be walled off and result in long periods of latency.

Secondary anemia of varying severity occurs in over 80 per cent of cases. As has been stated, the symptoms resulting from the pelvic lesions are by no means characteristic of tuberculosis, but are more or less common to pelvic inflammatory disease in general. Menstrual disturbances are usually present and may be either due to an accompanying endometritis, or metritis, or to ovarian involvement. Pulmonary tuberculosis in itself, without pelvic involvement, is prone to produce menstrual disturb-

ances, a subject which will be considered in detail in a subsequent chapter. An analysis of our 30 cases showed that all suffered more or less from menstrual disturbances; in 1 case amenorrhea had been present for three months and menstruation had been scanty and irregular for nine months; 15 showed some tendency towards irregularity and scantiness of flow; in 14 the flow was normal, or increased in amount; in 5 the periods were too frequent; in 27 more or less dysmenorrhea was present, and in 21 this was quite a marked feature. Although the character of the dysmenorrhea may vary, it is usually of the congestive type. It generally begins 12 to 48 hours or even more before the appearance of the menstrual flow and becomes less severe after the second or third day. The pain is of a dull, heavy, aching character, is worse over the lower abdomen, and is generally accompanied by backache and malaise. During the dysmenorrhea the general tenderness over the lower abdomen is increased. Slight tenderness and enlargement of the inguinal lymphatic glands is sometimes present at this time.

The dysmenorrhea in these cases may result from the primary lesion, from congestion of the diseased pelvic organs, especially the endometrium, may be ovarian in origin, or from a combination of these causes. Barbour and Watson⁴⁹ believe the dysmenorrhea is usually ovarian in origin, and is caused by a subalbugineal castration. It is noticeable that in all our cases in which the flow was increased in amount there was either an ovarian involvement or a well defined tuberculous endometritis, or both, showing that salpingitis alone has little or no effect upon the regularity or amount of the menstrual flow. This is in accordance with the findings of Boldt,⁵⁰ who states that in tubal disease, when not associated with ovarian lesions, the menstrual flow is not likely to be changed. In a series of 45 cases of tuberculous salpingitis, Baisch⁵¹ observed menstrual disturbances in 50 per cent. It is probable that in these cases there was some ovarian involvement in the majority of cases. As tuberculous salpingitis is usually bilateral, sterility is usually the result, despite the fact that in more than half the cases at least one tube is patulous. In this connection, however, it is important to remember that the tuberculous tube exhibits a remarkable tendency to remain patent, much more so than do tubes affected with any other variety of infection.

Pain is usually a more or less pronounced symptom, although Kelly⁵² remarks upon the frequent absence of this symptom in children. The pain is usually general over the lower abdomen and is usually intensified at the menstrual periods. Defecation is often painful, especially in those cases in which the appendages are adherent to the rectum. As a result of this pain a constipated habit is often acquired. The accumulation of

hard feces within the pelvis tends in time to augment the pelvic inflammation, and in this manner a vicious circle is established. In some patients the symptoms resulting from the sluggish action of the bowels constitute in themselves a marked feature in the case. If the inflamed adnexa lie anterior and are adherent to the bladder, vesical symptoms, such as frequent micturition and dysuria, are more or less pronounced, and unless a pelvic examination is made, the condition may be mistaken for an uncomplicated case of cystitis. Distention of the bladder and emptying of it may also cause pain. Backache, chiefly in the lower lumbar and sacral regions, is not infrequent, and frontal or occipital headaches may occur. During the chronic stage fever as a result of the pelvic lesions is often absent, although an evening rise, especially in cases in which there is pulmonary involvement, is very characteristic. Not infrequently in fairly quiescent cases the rise will be but slight, often not more than a fraction of a degree. A slight evening rise is an extremely suggestive symptom. A slight rise in temperature following a pelvic examination is common to all types of pelvic inflammatory disease and is a valuable diagnostic symptom in those cases in which the pelvic lesions are small or palpation difficult. During the chronic stage there is usually no leukocytosis or only a slight increase above the normal. All the symptoms are likely to be worse in the afternoon after the patient has been upon her feet, and are ameliorated by rest in bed. The discomfort is increased by exercise and pressure, such as may be produced by tight clothing about the waist or lower abdomen.

The vermiform appendix is secondarily involved in a definite proportion of cases, and as a result tenderness over McBurney's point is not infrequent, but is perhaps less often present than in gonococcal infections. In our 30 cases of tuberculous salpingitis more or less appendiceal involvement was present in 10; in 3 of these tuberculous appendicitis was present, and in 7 peri-appendicitis.

As has been mentioned, the severity of constitutional symptoms varies widely in different cases. They are more frequent and pronounced in these than in the gonococcal variety of chronic pelvic inflammatory disease. This is due to the fact that in a large majority of cases the constitutional symptoms are due not alone to the pelvic lesions, but are also often caused by the primary infection in the lungs or elsewhere. The patient is usually more or less incapacitated and tires easily. Usually loss of weight and general ill health are present, although cases vary markedly in this respect. Tenderness over the lower abdomen is often marked, and in severe cases the gait may be almost characteristic, the patient walking slowly, stooping forward, often inclining to one side or

the other, a hand being placed over the site of the pain. These patients may be observed to lower themselves carefully into a chair, and are apt to sit stooping forward, often bending towards the side of greatest pain. The same cautious action is observed when the woman arises out of the chair and at all times care is exercised to guard the abdomen from trauma or jolts of any kind, such as getting out of a street car, or going down steps, etc. During the latter maneuver the patient is likely to step down somewhat sideways, one step at a time, in the meantime holding on to the hand rail, somewhat after the manner sometimes adopted by young children. Dyspareunia is usually present, and as a result of prolonged suffering and general ill health, neurasthenia not infrequently results.

Abdominal palpation reveals the presence of resistance and tenderness over the affected areas, and in thin subjects or where the lesions are massive a tumor may be sometimes felt in one or both ovarian regions. ✓ Vaginal examinations show induration and tenderness in one or both vaginal fornices. The cervix is more or less fixed and attempts to move it in any direction cause pain in the ovarian regions and along the broad ligaments. The uterus is often in retrodisplacement and adherent, and in those cases where there is a metritis it is enlarged.

The tube and ovary are often bound together, forming an indistinguishable, adherent, tender, inflammatory mass, over which, in cases of large accumulations of fluid, fluctuation may be elicited. Fluctuation is more likely to be noticeable in thin patients, and in those cases in which massive lesions are present. More often fluctuation is absent and the tumor has a hard elastic feel. There may be bulging into one or both vaginal fornices. In some cases the ovary can be palpated as a separate structure, either normal or increased in size. In many cases, however, it cannot be differentiated until the abdomen is opened. As a rule the condition is bilateral, although frequently the pathologic process is more massive on one than on the other side.

In our series 28 cases were bilateral, 2 were unilateral, and even the latter, owing to the difficulty in macroscopic diagnosis, are doubtful, as in these 2 cases the tubes appeared entirely normal and were not removed, the character of the infection being unsuspected by the surgeon at the time of operation. The longer the duration of the case, and the more acute the symptoms, the more massive are the lesions likely to be. Occasionally small lesions will produce marked symptoms and the converse may also occur, especially when the collections are serous in character and the general peritoneal cavity is uninvolved. Occasionally nodules can be felt in the Douglas pouch, and, when present, are very suggestive of this type of infection. The differentiation between puru-

lent, serous, and hematogenous collections is extremely difficult by palpation alone. In purulent cases a slight rise of temperature of a half or one degree, following examination, is significant. On palpation a pyosalpinx frequently imparts a hard resistant sensation to the examiner's fingers, whereas serous collections are more elastic and often less adherent. Hydrohematosalpinges give the same general sensation on palpation as do simple serous accumulations. The typical retort shape, often assumed by non-purulent tubal accumulations, sometimes acts as a guide in determining the variety of the lesion present. This shape is relatively frequent in cases of tubal tuberculosis, in which form of infection the lesions are nearly always most marked in the ampulla of the tube, and not infrequently the inner two thirds of the organ, being comparatively normal or somewhat drawn out, forms a sort of pedicle. Such tubes may undergo torsion and upon palpation may be mistaken for cystic ovarian neoplasms. The rare cases of hematosalpingitis not due to tubal pregnancy impart a soft doughy feel to the examiner's finger.

Occasionally, especially in the early stages, the tubes are small and soft, and in these cases the demonstration of salpingitis by means of palpation is extremely difficult. Even after the administration of a general anesthetic, this may be almost impossible. Tenderness over the tube and fixation of the ovary are always significant. It is especially in these cases that an accurate history is of great importance in arriving at a correct diagnosis.

Diagnosis.—As in most other affections, whether of the genital tract or elsewhere, the correct diagnosis may be either easy or extremely difficult to arrive at. The fact that a pelvic peritonitis is present is usually easily ascertained. The determination of the variety of infection is, however, in many cases more difficult. Not infrequently the pelvic symptoms are more or less masked by those produced by the primary lesion. In some cases an absolute diagnosis is impossible, and a tentative diagnosis, arrived at by exclusion of the ordinary forms of infection, is the best that can be done. As a rule, the onset is more insidious than in the other forms of pelvic inflammatory disease, and, as has been stated, these symptoms are often overshadowed by those produced by the primary lesion. Von Franque relates instances in which the first symptom has been sterility, and warns against treating women in general for this symptom, without first excluding this form of infection. In the case of the gonococcal type of infection, the fact that the patient is a married woman or one of loose morals, and the evidence of gonorrhea in the lower genital tract are points which put the examiner on his guard for this variety of infection. In the case of streptococcus or staphylococ-

cus infection the fact that these usually follow the emptying of a pregnant uterus, whether at or before term, or succeed some intra-uterine manipulation, the sudden onset, the high temperature, the severity of attack in general, are suggestive of these organisms. In a definite proportion of patients the incumbents of tuberculous salpingitis, none of these symptoms are present, and this fact in itself is very suggestive of a tuberculous infection. A history of pleurisy and susceptibility to bronchitis is always suggestive of this form of infection. A definite proportion of cases is secondary to tuberculous peritonitis or to osseous lesions. Enlarged lymphatic glands in the neck are present in some patients. Indeed the presence of tuberculosis in any other portion of the body is suggestive. In a certain percentage of cases, however, no evidence of the primary focus is present. It should also be borne in mind that tuberculosis is one of the most frequent forms of infection, and because a woman has a tuberculous pulmonary lesion this does not prevent a gonococcal or other variety of pelvic infection. When a salpingitis occurs in a virgin, the chances are largely in favor of its being tuberculous in origin, and if, in addition, the disease is bilateral and associated with a demonstrable primary lesion, such as a pulmonary tuberculosis, the diagnosis is almost certain. The existence of a chronic cough should in all cases put the examiner on his guard for this form of salpingitis.

Tuberculous salpingitis may occur in young girls and children before menstruation, and although gonococcal vulvovaginitis in rare instances results in ascending infection involving the tubes, it is comparatively rare as compared to tubal lesions in children caused by the tubercle bacillus. The time of onset of the initial symptom of the pelvic trouble is also some aid in determining the type of infection. In the gonococcal cases the spread to the body of the uterus and to the tubes nearly always follows a menstrual period and less frequently the emptying of a pregnant uterus or intra-uterine manipulation, whereas in tuberculosis this is not commonly the case. Furthermore, tuberculosis of the tubes tends to be somewhat less acute and painful as a general rule than does the Neisserian infection. The fact that tuberculous salpingitis is distinctly less amenable to local and general treatment, such as copious hot douches, rest in bed, and the regulation of the bowels, is worthy of note and is also a suggestive point.

From appendicitis the disease can usually be readily differentiated by its bilateral involvement, the presence of a primary focus, its pain low in the abdomen, the induration of the broad ligament, the presence of adnexal lesions as determined by palpation, the absence of marked tenderness over McBurney's point, and the absence of a history of in-

discretion in diet, etc. So also the history and finding on examination differ quite markedly from those usually observed in tubal pregnancy.

In 4 of 11 cases examined, the author has been able to demonstrate tubercle bacilli in the leukorrheal discharge. Cummins⁵³ has reported good results by this method. He is careful to obtain the secretion for examination from the depths of the cervical canal, as an additional safeguard in eliminating the smegma bacillus. The endometrium is at least partly involved in many cases of advanced tubal tuberculosis. In these cases, therefore, it is only a matter of persistence to find the tubercle bacillus in the discharge. Care must necessarily be observed to exclude the smegma bacillus. Meyer-Rügg⁵⁴ is of the opinion that only in exceptional cases are bacilli found in the secretion. Orthmann⁵⁵ has been able to demonstrate tubercle bacilli in 42 per cent of cases. Doubtless animal inoculation, if carefully carried out, would prove of value in this connection, but the time required for such diagnostic methods is a distinct drawback, and, as the treatment is likely to be operative, no matter what form of infection is present, this nullifies the value of the method. The examination of the discharge by staining methods is naturally only of value in positive cases, the failure to demonstrate this organism by no means excluding the presence of tuberculosis. Höhne⁵⁶ has advocated evacuations of pelvic fluid by puncture and animal inoculation of the material thus obtained. This procedure may be of value in certain cases, but certainly is not advisable as a routine diagnostic method. Undoubtedly valuable information may be obtained by the examination of such material, when the operation of vaginal incision is indicated from a clinical standpoint. Sellheim²⁴ recommends the histologic examination of portions of the uterine mucosa for evidence of tuberculosis.

Tuberculin has been employed as an aid to the diagnosis. Pankow⁵⁷ states that he observed a focal reaction in three cases of non-tuberculous pelvic inflammatory disease, but that in one of these the reaction may have been caused by menstruation. Sahli⁵⁸ has emphasized the point that the sensitiveness to tuberculin is increased for a few days prior to menstruation. Beer⁵⁹ states that focal reaction in the absence of tuberculosis is exceptional. Mohr⁶⁰ is of the opinion that a negative response excludes tuberculosis, but Beer thinks a general plus and a focal response is practically invariably due to a focal tuberculosis, and such a response locates the diseased area. A general minus focal response is of no practical value, as the most careful examination cannot positively exclude a tuberculous focus in other parts of the body, which may give the general reaction. Tuberculin should not be employed at or near the menstrual period.

DIFFERENTIAL DIAGNOSIS BETWEEN TUBERCULOUS, GONOCOCCAL AND STREPTOCOCCAL PELVIC INFLAMMATORY DISEASE

<i>Tuberculous</i>	<i>Gonococcal</i>	<i>Streptococcal</i>
1. Often a family history of tuberculosis; 25 per cent (Lock ⁶¹).	1. Family history of tuberculosis incidental.	1. Family history of tuberculosis incidental.
2. Any age, although most frequent between 20 and 35. The most frequent cause for pelvic inflammatory disease in childhood.	2. Most frequent during active sexual life. Rare at other times.	2. Most frequent during active sexual life. Rare at other times.
3. Rarely primary. Nearly always a primary lesion elsewhere in the body. The latter may be quiescent or resolution may have occurred. Close questioning will nearly always elicit history pointing towards tuberculosis in other parts of the body; a history of lung, intestinal, peritoneal, bone or joint disease very suggestive.	3. No history of tuberculosis elsewhere in the body. (In this connection it must be remembered that tuberculosis is an extremely frequent disease and that persons suffering from it are by no means immune to other forms of pelvic infection.) If present, it is incidental.	3. No history of tuberculosis elsewhere in the body. If present, it is incidental.
4. General health often impaired as a result of primary lesions.	4. General health good except as impaired by pelvic lesions.	4. General health good prior to onset of pelvic infection.
5. Relatively as frequent in the virgin as in those in whom defloration has occurred.	5. Extremely rare in virgins.	5. Extremely rare in virgins.
6. Onset of pelvic attack often between menstrual periods.	6. Pelvic attack usually follows a menstrual period and less frequently the emptying of a pregnant uterus or intra-uterine manipulation.	6. Pelvic attack nearly always follows the emptying of a pregnant uterus or intra-uterine manipulation of the pregnant or parturient uterus.
7. Generally a gradual insidious onset. Previous history pointing to primary lesion in other part of the body.	7. Onset more severe than in the tuberculous. Previous history of leukorrhea, urethritis, and bartholinitis.	7. Onset severe and evolution of symptoms rapid. Often introduced by a chill followed by hyperpyrexia. Usually a history of pregnancy and intra-uterine manipulation.

<i>Tuberculous</i>	<i>Gonococcal</i>	<i>Streptococcal</i>
8. Temperature not as a rule high, and in exceptional cases may be normal. Slight evening rise of 0.5 or 1 degree. Fever often continues over long periods.	8. Fever of 100°-102° usually during attack; generally continues 5 to 10 days, and is followed by a period of normal temperature.	8. Hyperpyrexia, 101°-105° F.
9. Pulse in proportion to temperature.	9. Pulse in proportion with or lower than would be expected with the temperature.	9. Pulse rapid and often out of proportion with fever. Often of bad quality.
10. Respiration often affected as a result of the primary lung lesion.	10. Respiration in proportion with temperature.	10. Respiration in proportion with temperature.
11. Menstrual disturbances frequently antedate pelvic symptoms. Scanty menstruation or even amenorrhea not infrequent.	11. Menstrual disturbances follow pelvic infection. Flow usually increased.	11. Menstrual disturbances, if present, follow pelvic infection.
12. Sterility frequent. (Disease is usually bilateral.)	12. Sterility frequent, but often follows pregnancy. (The so-called one child sterility.)	12. Sterility relatively infrequent. Disease chiefly attacks cellular tissue of broad ligaments.
13. Pelvic pain less. Onset often masked by symptoms of the primary infection.	13. Pain more marked feature.	13. Pain more marked.
14. Pain and tenderness usually bilateral.	14. Often more or less localized to one or other ovarian region and becomes bilateral in later stages.	14. May be either unilateral or bilateral.
15. Primary lesion elsewhere in the body. No bartholinitis, urethritis, or cervicitis.	15. Evidence of gonorrhea in lower genital tract. Leukorrhea always present, usually yellow and purulent or mucopurulent.	15. No gonorrhea, but evidences of recent pregnancy. Leukorrhea usually present and often thin and watery.
16. The first portion of the genital tract attacked is the tubes, the endometrium being subsequently invaded. In other words, genital tuberculosis is a descending infection, so that bilateral symptoms antedate leukorrhea and other symptoms of endometritis.	16. Is an ascending infection. First the lower genital tract, then the mucosa of the body of the uterus, and from thence the adnexa, so that leukorrhea and urethritis, etc., antedate the pelvic symptoms.	16. Sudden onset and rapid involvement of ovarian structures. Infection gains access through cervix or uterus.

<i>Tuberculous</i>	<i>Gonococcal</i>	<i>Streptococcal</i>
17. Tubercle bacilli may be demonstrated in the leukorrhea. (Negative findings do not exclude tuberculosis.)	17. Gonococci may be demonstrated. (Negative findings, unless frequent and carefully performed, do not exclude gonorrhea, especially in the chronic stage.) Gonococci usually readily demonstrated in the acute stage.	17. Streptococci may be demonstrated. No tubercle bacilli or gonococci present.
18. Cervix normal.	18. Cervix, reddened area surrounding the external os.	18. Cervix, softened, patulous, and often exhibits evidence of recent pregnancy.
19. Uterus normal in size and consistency. Slight symmetrical enlargement is however not rare.	19. Normal or somewhat enlarged.	19. Usually enlarged (subinvolution).
20. Cellulitis not marked. Primary pelvic infection in tube.	20. Cellulitis not marked. Infection chiefly in tube.	20. Broad ligament chiefly involved. Tubes, if diseased, are secondarily so.
21. Nearly always bilateral.	21. Often unilateral, especially in the early stages of the disease.	21. May be either unilateral or bilateral.
22. Palpable lesions of the tubes are in the normal location of these organs, unless the tubes have prolapsed into Douglas' pouch, etc.	22. Palpable lesions of the tubes are in the normal location of these organs, unless the tubes have prolapsed into Douglas' pouch, etc.	22. Chief lesions are lower in pelvis than either of the other forms. Base of broad ligament nearly always thickened and tender and firmer than normal. Cervix fixed and attempt to move it causes marked pain.
23. Tubes sometimes nodular, and this characteristic may sometimes be demonstrated by bimanual examination.	23. Nodular character of tubes less frequent. Often sausage shaped. A small adherent ovary may however simulate nodule.	23. Tubes not nodular, often soft and edematous.
24. Both ovaries likely to be adherent, but marked enlargement not frequent.	24. One or both ovaries may be adherent. Enlargements more frequent than in tuberculosis.	24. One or both ovaries often enlarged and seat of adhesions or abscesses.
25. A small but demonstrable amount of free fluid in peritoneal cavity often present during height of attack.	25. No free demonstrable fluid. Disease chiefly limited to pelvis.	25. A well marked general peritonitis may result. In other cases no demonstrable free fluid is present in peritoneal cavity.

<i>Tuberculous</i>	<i>Gonococcal</i>	<i>Streptococcal</i>
26. May be positive for various tuberculin tests.	26. May be positive for gonococcal complement fixation test.	26. Unless tuberculosis or gonorrhea is present in conjunction with the streptococcic infection, the foregoing tests are negative.
27. Leukocytes normal in number or leukocytosis not marked (excepting where large collections of pus are present, where mixed infection has occurred).	27. Leukocytosis during the acute attack.	27. Well marked leukocytosis usually present.
28. A well marked anemia, often as a result of the primary lesion, often present.	28. Hemoglobin varying with stage of disease and individual case. Less marked anemia than in tuberculosis.	28. Anemia often marked, especially in late stages.
29. No organism in the blood of the general circulation.	29. No organism in the blood of the general circulation.	29. Blood cultures frequently positive.
30. Runs a slow prolonged course. If death occurs, it is usually due to tuberculous lesions other than of the genital tract	30. Acute attack usually lasts from 5-10 days, continuing at varying intervals over period of years. More or less invalidism. Rarely terminating fatally.	30. Sharp acute course, usually ending in complete recovery or death.
31. Resistant to palliative treatment as usually applied to cases of pelvic inflammatory disease.	31. Palliative treatment nearly always results in at least temporary improvement.	31. Palliative treatment often curative.
32. In a definite proportion of cases results in, or is followed after weeks or months by, a general tuberculous peritonitis.	32. General peritonitis extremely rare.	32. If general peritonitis occurs, is of an acute severe type and occurs during the course of the pelvic infection.

Prognosis.—In considering the prognosis it must be remembered that in the great majority of cases the genital infection is secondary. The primary lesion must, therefore, be as thoroughly studied as the pelvic, and is usually of grave importance. Statistics, moreover, unless from a large series of cases, and compiled with extreme care regarding the extent and location of the primary lesion, are apt to be misleading. Indeed so many factors enter into the question of a prognosis that ordinary statistics are practically valueless. All the points of the case must be carefully studied and the prognosis based upon the findings in the individual patient. The age of the patient, the duration, course, character,

extent, individual disposition, the social and financial standing of the patient, are all points which must be considered, both as regards the course of the primary as well as of the genital condition. Mayer⁹ is of the opinion that the presence of high fever before operation is an extremely unfavorable sign. Fever, either the result of a primary or of the pelvic lesion, is undoubtedly an unfavorable sign, and is generally an indication for delay in operative intervention. Of 22 cases of tubal tuberculosis—in none of which was there a general peritoneal involvement, all of which were operated upon at least 3 years prior to our study, while some of them had been operated upon 12 years ago, and all were traceable—16 are alive. About 2/3 of this series of cases were ward patients and are therefore presumably unable to follow out an ideal course of postoperative hygienic treatment.

Baisch⁵¹ states that, of 110 cases of tuberculosis of the peritoneum or genital organs occurring at the University of Tübingen during the ten years prior to his report, 40 died within four years after treatment; there were no recurrences after this period. Five-sixths of the fatal cases died during the first year. Of 55 cases of tuberculous salpingitis, 13 cases were not operated upon; of these 8 died, in 4 the general condition was too grave to warrant operation, and in 4 others pulmonary lesions were advanced. Five improved under expectant treatment, but only 1 was cured. Of 32 patients treated surgically, 9 died, 3 from peritonitis following injury to the rectum, 1 from bronchopneumonia; 5 died after leaving the hospital, one from pulmonary tuberculosis; 13 cases were cured. In 6 new inflammatory tumors appeared. The percentage of recurrence was highest in those patients in whom only one tube was removed, the other appearing normal at the time of the operation.

Evens³⁵ has reported a series of 23 cases of adnexal tuberculosis, in which conservative operations were performed when possible, and the uterus removed only for special indications. There were 2 postoperative deaths, 1 from postoperative hematemesis and 1 from septic nephritis; 16 of the remainder were traced and did well; in 3 there was good operative recovery, but they were subsequently lost sight of. One patient died one year after operation from the primary lesion, and one case required a second operation for the removal of a previously conserved tube.

Ollivier⁶² has recorded the histories of a series of 116 cases of genital tuberculosis. Of these there were 9 operative deaths, 8 died later on, 19 were lost sight of and 80 were alive at the time of the report, some as long as 10 years after the operation.

Bovis and Olow⁶³ report the histories of 55 cases. One died shortly

after operation and 3 others within 18 months; 43 of the series were able to work 1 to 15 years after operation. Mannheimer⁶⁴ reported a series of 22 cases operated upon, with 1 death. Twenty of these patients were followed subsequently and it was found 1 had died of pulmonary tuberculosis, and 1 was ill from the same cause. Eight of these 22 patients died within 5 years of pulmonary tuberculosis. Lindquist, at the same meeting, records the results of operation in 20 cases. Of these there were 14 normal recoveries, and 6 left the hospital with fistulas—no operative mortality. Frölich at the same time reports 50 cases, 2 operative deaths and 2 who died subsequently; 13 were improved, 29 were well, and 4 untraced. Krönig⁶⁵ believes the prognosis in genital tuberculosis should be extremely guarded. Geist⁶⁶ reports 28 cases with 3 operative deaths. There were 2 deaths subsequently, due to pulmonary tuberculosis. A number of fistulae developed and the average stay of these patients in hospital was 6 weeks; 13 of the patients were discharged from the hospital well, and 12 improved.

Schlimpert⁶⁷ states that, in 2,173 postmortem examinations upon tuberculous individuals, 73, or 3.5 per cent, had some form of genital involvement. Simmonds,²⁰ in 6,000 postmortems upon women, found the genital organ involved in 1.33 per cent. In none of Schlimpert's or Simmonds' subjects was the genital tuberculosis the cause of death, and in only 3 cases did the subjects come to the mortuary from gynecological wards. Although undoubtedly the genital lesions are of secondary importance in comparison with the tuberculous foci in other parts of the body, the author's experience does not by any means bear out the result of Schlimpert and Simmonds, as severe and even fatal lesions have been observed by him in a considerably higher proportion than found in the statistics above quoted. This is undoubtedly due to the character of the material from which the observations have been made.

Desgouttes and Ollivier⁶⁸ believe that intestinal lesions, particularly those of the small intestine, have an especially unfavorable bearing upon the prognosis in cases of tuberculous adnexitis. These authors state that the prognosis depends very largely on the extent to which the intestines have become involved. When there are no intestinal adhesions, the operation is comparatively simple and safe. When only the large intestines are involved, all adhesions, both of the pelvic organs and peritoneum, should be freed with the greatest care. When the small intestines are involved, the prognosis becomes less favorable.

The operative mortality from the operation per se in properly selected cases of tuberculous salpingitis is not greater than in other chronic tubal infections. The fact that pulmonary lesions are often present does,

however, markedly increase the operative risks. The subject of anesthesia and surgical intervention in general in phthisical individuals will be considered in a subsequent chapter. The most favorable results are obtained in those cases in which it is possible to remove the entire intraperitoneal focus of the infection.

All these patients exhibit a tendency to continue subacute or chronic symptoms despite palliative treatment, and the dangers of a subsequent general peritonitis are always present. The tendency to resist palliative treatment is a sign of considerable diagnostic value and is a point which has not been sufficiently emphasized.

When an ordinary case of pelvic inflammatory disease is observed which does not show improvement under palliative treatment, a tuberculous origin should be suspected. It is true that many tuberculous patients do show improvement, but the proportion is smaller than in the commoner varieties of adnexitis. The simple evacuation of a pelvic abscess is much less favorable than when the entire intraperitoneal focus of infection can be removed, and nearly always a more prolonged convalescence may be expected in cases of tuberculous origin than in those of other forms of pelvic infection. In such cases chronic fistulas are prone to result. Indeed, Hannes⁶⁹ is of the opinion that vaginal incision is of little or no value in the case of tuberculous pelvic inflammatory disease.

The final outcome of operative cases after leaving the hospital is less favorable in tuberculous cases than in those due to other varieties of microorganisms. First, these patients must face the dangers of the primary lesion, the possibilities of the development of a general or local tuberculous peritonitis, the former being a not infrequent result, as well as the development of new secondary lesions. The dangers of local recurrence are especially great in those cases in which tubercles are observed in the peritoneal cavity which are not removable at operation, and in those cases in which one tube only is excised. In our laboratory tuberculosis has been demonstrated in every specimen of macroscopically normal tube removed in conjunction with tuberculous salpingitis of the opposite side. It should not be inferred from this that every case is bilateral, but there is evidence to show that this infection is usually bilateral, even when one of the tubes is macroscopically normal, and the leaving of such a tube certainly increases the risks of a local recurrence and also for the development of a general tuberculous peritonitis. Mayer-Rügg⁵¹ is of the opinion that genital tuberculosis is rarely the developing point for a tuberculous peritonitis. As has been stated, however, in a certain proportion of cases studied by the author, a general peritonitis has developed,

so that we feel that this complication must be considered. Albrecht and Schlimpert¹ found that, in a series of cases of general tuberculous peritonitis occurring in women, 12 per cent originated in the genital tract. The possibility of a general miliary tuberculosis developing subsequent to operation must also be considered. In our series of cases this has never developed. A study of the literature of this subject shows that such a complication may take place and is most prone to occur after operating upon acute cases. Excluding the operative mortality, the great majority of fatal cases occur in the first year.

Treatment.—The question of the form of treatment to be employed for cases of tuberculosis of the adnexa is still somewhat in doubt. No rule of thumb can be formulated, and each case must be judged individually. Whether operative intervention or palliative treatment will give the best results can only be decided after studying the particular case. At the risk of repetition, it must be emphasized that these cases are usually secondary, and therefore the condition of the primary lesion is of the utmost importance.

All patients, the incumbents of pelvic inflammatory disease in which a tuberculous origin is suspected, should be subjected to an extremely rigid physical examination, in which the entire body should be carefully studied. According to von Franque, renal tuberculosis is comparatively infrequent as an accompaniment of tuberculous salpingitis; however, this complication was present in one of our cases, and we believe the kidneys should be carefully investigated in all cases, and that a cystoscopic examination is indicated in all; and, should any doubt exist, the ureters should be catheterized. Fortunately, renal tuberculosis in combination with genital lesions is less frequent in women than in men.

Although primary cases of tuberculous pelvic inflammatory disease do occur, they are so rare and the difficulty in making such a diagnosis is so great that for practical purposes it is safe to regard all cases as secondary, and so treat them. As actually observed, cases of tuberculous adnexitis may be divided into three (3) classes—1st, those in which there is an active primary lesion; 2nd, those in which there is a demonstrable but non-active primary lesion; and 3rd, those in which no primary lesion can be diagnosed with certainty. Class 1 comprises those cases in which there is an active primary lesion, and should not, as a rule, be submitted to operation, the exception being patients in whom some palliative operation is performed to relieve pain or other symptoms, such, for example, as the vaginal incision for the evacuation of pus in a large pelvic abscess. Extensive operations should certainly never be performed. Under proper hygienic and other treatment, the primary lesion may improve and the

case may eventually come under the heading of class 2. Operations during the acute stage of the primary lesions are doubly hazardous, because of the dangers of dissemination of the infection by the actual operative procedure and the lessened resistance exhibited by those patients. General anesthetics are contra-indicated in the presence of active pulmonary lesions. Spinal anesthesia may be necessary in some of these cases. Minor and even certain major operations may in some cases be performed under local anesthesia, but the general rule to be adopted in cases in which there is an active primary lesion is non-operative interference, and this is particularly true when the primary lesion is in the lung. Proper hygienic and medicinal treatment is the course to be recommended for this class of patients, together with appropriate measures indicated, directed towards the pelvic condition.

Class 2 comprises those cases in which the greatest difficulty will be encountered in deciding the best form of treatment. Here each case must be carefully studied individually. It must be remembered that the operative risks in these patients is much greater than in the ordinary patient. The chief points to be considered are the extent and character of the primary lesion and the actual danger to the patient from the genital lesion, the amount of discomfort produced by the latter, and the type of operation required to alleviate or cure the disease of the genitalia. As has been elsewhere stated, the subject of anesthesia in tuberculous patients will be considered in detail in a subsequent chapter. It is obviously a very important one in these cases. Our experience has been that ether anesthesia for patients with moderately small non-active pulmonary lesions has not proved exceptionally hazardous. However, this danger is a real one and must be considered. Certainly all cases belonging to this class should be carefully studied for a considerable period of time before operative intervention is decided upon, the exception to this being when the operation required is of a life saving character or can be performed under local anesthesia.

Class 3 will generally be treated as ordinary pelvic inflammatory disease and the diagnosis of the tuberculous origin of the condition will often only be made after the abdomen is opened, or in the laboratory when the histologic specimens are examined. All patients belonging to this class, in whom tuberculosis is suspected, as for example, if pelvic inflammatory disease be diagnosed in a virgin, should be treated as if they belonged to class 2, and every precaution to prevent an exacerbation of a possibly existing primary lesion should be adopted.

Little has been said regarding spontaneous cure of tuberculous sal-

pingitis. This undoubtedly occasionally occurs, but is rare, although partial resolution is not infrequent. Beyond question, many tuberculous women suffer from mild adnexal lesions, which do not require or receive any local treatment, and which subsequently undergo partial resolution. This is amply proven by a study of postmortem material from tuberculous women in whom some 7 per cent show evidence of salpingitis. It is true some of these may not have been of tuberculous origin, but even in series of autopsies verified by histologic or bacteriologic examination, a definite proportion of tuberculous tubal lesions is found in women in whom they were unsuspected during life, this showing that in these cases the symptoms of the pelvic disease were either masked by those of the primary lesion, or were of such a mild character that attention was not directed to the pelvic condition. At present doubtless far more can be accomplished by hygienic and general measures than in the past, and it is of the utmost importance that all tuberculous patients should receive a long course of postoperative care and observe the usual rules for tuberculous patients. This applies to all classes and is usually best carried out in a sanatorium. Out door life, forced feeding, etc., are, generally speaking, of utmost importance, and are quite if not more beneficial to the patient who has been suffering from a tuberculous pelvic inflammatory disease than is the operation.

A preliminary treatment of this character prior to the operation should also be advised in the majority of cases, certainly in all cases in which the pelvic lesions are not materially depleting the strength of the patient. Rollier⁷⁰ has treated 700 patients suffering from various forms of surgical tuberculosis by exposure to the sun's ray at Leysin, Sweden, during the past 9 years, and is convinced of the benefits to be derived from this form of treatment. He keeps his patient in the open air practically all the year.

As in pelvic lesions, the result of microorganism other than tubercle bacillus, operations should be avoided during the active stage of the disease, and in all cases the patient should be subjected to a course of preliminary local treatment similar to that now generally adopted for non-tuberculous pelvic inflammatory disease. In cases of pelvic inflammatory disease of tuberculous origin it is sometimes difficult to determine if fever is being continued by the primary or by the pelvic lesion. Practically this is of no great importance, as patients should not as a rule be subjected to operation in whom hyperpyrexia is present. The local treatment consists of rest in bed, preferably in the Fowler position, the regulation of the bowels by means of mild cathartics or enemata, the application of heat to the lower abdomen, and the employment of frequent,

copious, hot vaginal irrigation. Hofmeier,⁷¹ Bumm,³⁶ and Freund⁷² advise cold during the acute stage. The application of heat to the lower abdomen, together with copious, hot douches is of great benefit and tends to promote absorption. Heat may be applied by means of hot sand bags, the weight being regulated to suit the comfort of the individual patient, or large hot poultices, rubber coils containing hot water, or a hot water bag may be employed. An electrically heated pad, such as can be procured in instrument supply stores, is the best means of applying heat to the abdomen. In any case the heat should be applied as constantly as possible, a temperature of 110° to 120° F. being maintained. A good working rule in this respect is to have the application as hot as can be comfortably borne by the patient.

Under this form of treatment, combined with proper feeding and hygiene, many cases will improve, and in a small proportion no operative treatment will be required. In the presence of extensive pelvic lesions of doubtful origin it has been, however, the author's experience that cases of tuberculous adnexitis are less susceptible to palliative treatment than any other form of pelvic inflammatory disease. Indeed, in some cases in which the primary lesions have been quiescent and difficult to detect, the continuance of the acute symptoms, as indicated by fever, increased pulse rate, pelvic pain, etc., after a moderate trial of the palliative treatment, has been the first symptom which has suggested the correct diagnosis of the cause of the condition.

Findley is a strong advocate of non-operative measures in the majority of cases. He states that in many cases the symptom complex complained of is often due not to the pelvic lesion, but to the primary lesion, and that tuberculosis of the genital organs in itself rarely causes death. Dysmenorrhea is frequently the result of pulmonary tuberculosis. The general peritonitis which sometimes follows in these cases is not necessarily secondary to the salpingitis, but may result from a hematogenous infection from the primary focus in the lungs or elsewhere. Findley emphasizes the facts that operation may awaken a latent primary focus and result in a general dissemination of the disease, that the mortality is relatively high, that there is at least some tendency towards self limiting of the genital lesions, so that when operation is necessary it should be as conservative as possible, especially in young patients. Patel and Ollivier⁷⁴ have reported the results of operations on 121 patients, all of whom were operated upon since 1900. In their series the abdominal route was more satisfactory than was the vaginal. As the result of their observations, they believe it unwise to save a uterus, if the ablation of the adnexa is necessary, and, on the whole, favor hysterectomy with bilateral

salpingo-oöphorectomy in the majority of cases. They think that the artificial menopause induced by the removal of both ovaries is less severe in tuberculous than in ordinary patients. Berkley's ⁷⁵ studies offer further evidence showing the advantages to be derived from hysterectomy in these cases. In his series of tuberculous adnexitis cases the uterus was involved in 29 per cent, and von Franque ⁷⁶ found a similar proportion. At the German Congress held in Munich in 1911 the majority, including Zweifel, Stöckel, Gottschalk, Menge, Küstner, Fehling, Opitz, Wertheim, Startz, and Sarvey, supported operative treatment for the majority of cases. Sellheim and Herff were less favorable to operation. Sippel recommended operation when conservative treatment failed. Nearly all warned against operation during the acute stage of the pelvic lesion, and urged that a thorough search for, and study of, the primary lesion be made prior to deciding upon the course of treatment.

Von Franque believes that the majority of cases of genital tuberculosis should be operated upon, not because there is any imminent danger of life, except in exceptional cases, but following the principle which applies to all forms of surgical tuberculosis, in which it is good surgery to remove the infected focus as far as is possible. Medical treatment, he believes, is slow, uncertain, and costly, and since the chief function of the genital organs is lost at any rate, it seems rational to remove them in order to prevent a further spread of the process. In 66 per cent of the cases permanent cures can be obtained. If the pelvic lesions are extensive, von Franque recommends a radical operation, removing the uterus and both adnexa; but if only the tubes are macroscopically involved, a bilateral salpingectomy is performed, leaving the uterus and ovaries. Murphy ⁷ also recommends operation in all cases of tuberculous salpingitis when the general condition does not contra-indicate it. He advises sparing the ovaries when possible, and stigmatizes the routine removal of the uterus as a pernicious practice. Patel ³³ states that patients with tuberculous salpingitis as a rule do badly if not operated upon.

OPERATIVE TREATMENT.—Presuming that operative interference has been decided upon, the type of operation to be performed is the next point to be considered. Shall the operation be conservative or shall the entire uterus and adnexa be removed. Much depends upon this point and many factors enter into the problem. Like similar treatment in other forms of pelvic inflammatory disease, no hard and fast rules can be formulated regarding this point. Our first object is to cure the patient. It is important to consider what structures within the pelvis are diseased. Statistics have shown that in over 90 per cent of cases of pelvic inflammatory disease, the tubes are involved. In the series of 30 cases from which our

studies have been made, this proportion reached 100 per cent. In the great majority of cases the involvement was bilateral, and even when one tube appeared macroscopically normal or only showed a few adhesions, histologic examinations usually revealed a more or less well marked invasion. Observers have shown that the endometrium is involved in about 20 to 30 per cent of cases. Extensive involvement of the myometrium is comparatively rare. On the other hand, true ovarian involvement is rather infrequent, although peri-oöphoritis is more common. Our custom is to conserve the uterus and one or both ovaries when possible.

In common with most American gynecologists, we favor the abdominal route when operating upon cases of pelvic inflammatory disease, the single exception to this being in those cases in which pus can be evacuated without traversing the peritoneal cavity, as in the case of an abscess pointing into the vagina. In the case of tuberculosis the abdominal route is especially to be desired, as a close inspection of the pelvic organs is of the utmost importance.

Minto⁷⁷ has performed a series of animal experiments, which he believes shows that oöphorectomy is advisable. In these tests control animals in which the ovaries were not removed succumbed in all cases earlier than did those in whom oöphorectomy was performed. Interesting as this series of experiments was, we do not believe that the results are analogous, or should be applied to the treatment of women. The author has elsewhere⁷⁸ stated at length the advantages of ovarian conservation when these structures are not hopelessly diseased. The fact that, in tuberculous pelvic inflammatory diseases, the ovaries are rarely actually invaded by the tubercle bacillus is added reason for this conservatism. Much will naturally depend upon the age of the patient and other circumstances surrounding the individual case. The case is, however, exceptional where at least one ovary cannot be safely saved.

Whether one or both tubes should be removed is often difficult to determine. Many factors, however, point to the advisability of bilateral salpingectomy as the routine procedure. With both tubes macroscopically diseased, even if one shows nothing more than adhesions, we believe that both should be removed. When one tube is diseased and the other is macroscopically normal, histologic examination of the latter often shows it to be the seat of a salpingitis. For this reason, a general radical attitude regarding the routing removal of both tubes in cases of tuberculous pelvic inflammatory disease is, we believe, to be encouraged. The only advantage in tubal conservation is to prevent sterilization. The advantages of fertility are less urgent in the tuberculous than in other forms of infec-

tion. Tuberculous endometritis is an accompaniment of tuberculous salpingitis in about 20 or 30 per cent of cases. The disease exhibits a tendency to especially involve the endometrium in the cornu of the uterus and to limit itself to areas about the internal os. The fact that in 1 in every 4 or 6 cases there is endometrium involvement is a strong argument in favor of a routine supravaginal hysterectomy. On the other hand, the operative mortality due to the prolongation of the operation, and the actual severity of the procedure is somewhat greater in hysterectomy than in bilateral salpingectomy.

After the abdomen has been opened the same operative indications should govern the surgeon as in the ordinary inflammatory case, with the exception perhaps that greater radicalism as regards surgery of the tubes is indicated in this form of infection.

The patient is sterilized by the removal of the tubes, but better conservative surgery can be performed by leaving the uterus, as the ovarian blood supply is less likely to be impaired. This is an extremely important factor in ovarian conservation; so, unless the uterus is macroscopically diseased, its conservation is advisable for this as well as for the preservation of the menstrual function. The sterilization of these patients in those cases in which the disease has not already accomplished this result is, as a general rule, less of a calamity than in the ordinary case of pelvic inflammatory disease, as pregnancy in the tuberculous patient is unadvisable in most cases and often extremely detrimental to the general health of the individual. When it is necessary to remove the uterus, a supravaginal hysterectomy is preferable to a panhysterectomy provided that the cervix is uninvolved. In a previous chapter the rarity of cervical tuberculosis has been shown.

Result of Operative Treatment.—The tendency towards the formation of fistulae of divergent varieties is greater in tuberculous than in non-tuberculous patients, and for this reason drainage should rarely be employed. The immediate operative mortality is not particularly great in properly selected cases, but the end results are less favorable, often owing to the development of other secondary lesions or to the lighting up of the primary focus.

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CHAPTER X

UNUSUAL MANIFESTATIONS AND REMOTE COMPLICATIONS

Tuberculosis and neoplasms—Ways of occurrence—Etiologic relation to cancer—Histologic similarity of certain forms of tuberculous salpingitis to carcinoma of fallopian tube—Types—Cases recorded—Tuberculosis and non-malignant tumors of the genital tract—Accidental or coincidental combinations—Pseudoneoplasms—Etiology—Infection of adenomyomata of uterus—Cases—Ovarian cysts—Histology—Summary—Tuberculosis of uterus causing pyometra—Illustration—Tuberculous tubal lesions—Torsion of tuberculous pyosalpinges—Factors—Action of diaphragm in cases—Rupture of tuberculous pyosalpinges—Collected statistics—Rupture of pyosalpinx in adjacent hollow viscera—Necessity for thorough pelvic examination—Extension of tuberculosis from pelvic lesion to other distinct areas—Tuberculous lesions in hernial sacs—Histologic study—Cases cited—Bibliography.

TUBERCULOSIS AND NEOPLASMS

A combination of tuberculosis and neoplasms of the genital tract may occur in one of two ways. A tuberculosis may be implanted upon a genital tract already the seat of a neoplasm and involve the tumor either on the surface, or, less frequently, in the substance of the new growth. The reverse may occur, that is, a neoplasm may develop from the genital tract already the seat of a tuberculosis. The pathological process resulting from either of these combinations may be identical, as far as the macroscopic and microscopic examination is concerned. In other words, a combination of a tuberculosis and a neoplasm may be purely an accident, the one having no relation to the etiology of the other. On the other hand, if, for example, it is found that the coexistence of cancer of the fallopian tubes and tuberculosis is more frequent than would occur from a mere accident from these two conditions, another explanation must be sought for. From a study of a large series of cases and of the literature bearing upon this subject, it would appear that, as far as cancer of the fallopian tubes is concerned a preëxisting chronic inflammation, such as is produced by tuberculosis, bears at least some etiologic relation to the occurrence of cancer; and this is what would be expected, if the Ribbert theory of preëxisting irritation, lessened resistance from preëxisting inflammation, etc., is taken into consideration. When, however, a tuber-

culosis of, let us say, the endometrium and tubes exists in a patient in combination with a uterine myoma, the accidental occurrence of the two conditions is probably the explanation. For, although little is known regarding the etiology of uterine myoma, the concurrences of these two conditions are of no greater frequency than would be expected from the incidence of these lesions. Given, however, a tuberculosis of the body of the uterus and a cervical carcinoma, the occurrence of these two conditions is less clear, and while still the theory of accidental occurrence of a carcinoma upon a tuberculous uterus is the most probable, the constant irritation to the cervical mucosa resulting from the discharge incident to the preëxisting endometritis may in some degree be an etiologic factor.

Tuberculosis and Carcinoma.—Harris,¹ Oertel,² Wolf,³ Schwalbe,⁴ Cone,⁵ Pepper and Edsall,⁶ and many others have recorded the existence of tuberculosis and cancer in organs other than the genital tract. The researches of Levin⁷ to some extent bear out the Ribbert theory regarding the etiology of carcinoma. This author showed experimentally that healthy testes of the rat withstood implantation of the Flexner-Jobling tumor, but that when certain irritants were primarily applied a "take" was almost constant. Kellert⁸ states that certain observers have concluded that tuberculosis and its toxins are more or less directly to be considered in the etiology of cancers. Dixon, Smith and Fox⁹ have apparently proved in animals that under certain conditions the tubercle bacillus and its products may stimulate epithelium to abnormal growth.

As regards the combination of tuberculosis and carcinoma in the genital tract, it seems safe to assume that they may occur accidentally in the same patient, or the inflammation may be, at least to some extent, a causative factor in the production of the cancer; the latter is especially likely to be the case when the neoplasm develops directly upon the tuberculous process, as in the case of tuberculosis and carcinoma of the fallopian tubes, and much less probable when the two occur at distant parts of the genital tract.

An example of both these types occurring in one patient has been reported by Lipschutz.¹⁰ The patient was a multipara, forty-four years of age, in fairly good general condition. She suffered from pain in the back and lower abdomen. The uterus was irregularly enlarged, in retroposition and adherent. A diagnosis of myoma with adhesions was made. Supravaginal hysteromyomectomy and bilateral salpingo-oöphorectomy were performed. The uterus was as large as a man's fist and contained a number of intramural myomata. The right fallopian tube at the ampulla passed into a tumor the size of a hazel nut. Histologic examination of this showed it to contain typical tubercles, and sections from the

center of the tumor revealed the presence of a papillary carcinoma. Lipschutz believes that the carcinoma in this case developed on an old tuberculous salpingitis. There was no recurrence five years afterward.

Von Franque¹¹ has also recorded the history of a case in which a cancer developed on an old tuberculous lesion. In studying 16 cases of the coincident occurrence of cancer and tuberculosis in the genital tract which he has collected from the literature, this author states that in none was there positive evidence that the carcinoma preceded the tuberculosis, whereas in 9 the reverse was known to be the case. In only 1 of these specimens did the cancer actually develop in a tuberculous process, in 7 the two were closely adjacent, and in 5 they were some distance apart. The fact that carcinoma is an acute condition and that tuberculosis is essentially a chronic one, would, even apart from any acceptance of Ribbert's theory, to a large extent explain the preëxistence of tuberculosis in many of these cases. Similar cases are recorded by L'Esperance,¹² Devic,¹³ Kaufmann and Wallart,¹⁴ Lady Barret,¹⁵ Maikoff,¹⁶ Glockner,¹⁷ and others.

Von Franque¹¹ has recorded the history of another case, in which a carcinoma developed in a fallopian tube, the seat of an old salpingitis. In this specimen, however, the tumor originated from a point in the mucosa apparently free from the tuberculous process.

D'Halluin and Delral¹⁸ have reported the history of an interesting case in which the uterus and adnexa were fused into an inflammatory mass the size of a man's fist. The fundus of the uterus was the seat of an adenocarcinoma and was surrounded by a tuberculous endometritis. The authors believe that the cancer developed from tuberculous granulations. Nassauer¹⁹ has reported the history of two cases in which tuberculosis of the endometrium coexisted with carcinoma of the cervix, and Wallart²⁰ has described a case of carcinoma of the cervix coexistent with a similar infection.

In the chapter on Pathology attention has been called to the histologic similarity of certain forms of tuberculous salpingitis to carcinoma of the fallopian tube. Especial care should be exercised in histologically differentiating these conditions.

Tuberculosis and Non-Malignant Tumors of the Genital Tract.

—Combinations of tuberculosis and non-malignant neoplasms of the genital tract are by no means infrequent, and for the most part should be viewed as accidental or coincident combinations. In our series of cases of tuberculosis of the genital tract this infection has been present twice in conjunction with ovarian neoplasms, and once with a uterine myoma. Kelly,²¹ in the examination of 1,800 uterine myomata, observed

one case in which there was tuberculous endometritis, and another in which the adnexa were tuberculous. The frequency of these combinations is of importance from a clinical viewpoint, as in most cases the predominance of symptoms and the findings on palpation point to a diagnosis of the tumor, and as a result the tuberculosis may be overlooked, unless care is exercised. A careful histologic examination is therefore indicated, for, as pointed out in a previous chapter, special postoperative treatment is indicated to all tuberculous patients. In a smaller proportion of cases the symptoms resulting from the tuberculosis will be found to mask those produced by the tumor. Pseudoneoplasms are frequent in certain forms of tuberculosis, as in salpingitis ischmaia nodosa or in some of the hypertrophic forms of this infection, such as are sometimes observed in the cervix, vagina, or external genitalia. In tuberculous peritonitis pseudo tumors are of frequent occurrence. Tuberculosis of the lower genital tract from the internal os downwards frequently produces lesions which, upon clinical examination alone, closely simulate true neoplasms. The ulcerative lesions of the cervix, vagina, and external genitalia are especially likely to be mistaken for carcinomata, and the hypertrophic forms may easily be mistaken for other tumors.

As has been stated, tumors of the genital tract may be accidental, and may develop either primarily or secondarily to the tuberculosis. They may spring from the area attacked by the tuberculosis or may arise from a distant and uninfected area. The tumor actually attacked by the tuberculous process may be invaded in one of two ways, either the surface of the tumor may be involved, or the actual substance of the neoplasms may be infected. The former is much the most frequent and is apt to occur when a tuberculous peritonitis or even only a salpingitis is present, in combination with any intraperitoneal pelvic tumor. The ordinary glandular ovarian cyst seems especially subject to this form of tuberculosis. On the other hand, and of less frequent occurrence, the substance of the tumor may be actually invaded by the tuberculous process. The etiology of this latter form of infection probably occurs in two ways, from without or by a blood or lymphatic infection from within. In the case of ovarian cystadenomata the infection from without is the most frequent, either as a direct extension from the capsule of the tumor to the underlying stroma, or the infection finds an avenue of ingress through a ruptured follicle, as more or less normally rupturing graafian follicles may occur in these tumors. In the case of infection of an adenomyoma of the uterus, especially of the diffuse variety, a direct extension by continuity from a tuberculous endometritis is probably the avenue of contamination in the great majority of cases.

Ivins²² reports the history of a case of an adenomyoma of the fallopian tube attacked by tuberculosis. In this case the uterine end of the tube was the seat of a firm, smooth nodule the size of a hazel nut, which upon histologic examination revealed the above condition. In the examination of tubal adenomyoma combined with tuberculosis care must be exercised, lest the nodules sometimes produced by a simple tuberculous salpingitis be confused with a true new growth. Miss Ivins believes her case to have been one of a true tumor combined with a tuberculosis. Von Franque,¹¹ and Parsons and Glendining²³ have reported the histories of cases in which the specimens closely resembled true adenomata, but in which the tumor-like formation was probably the result of tuberculosis, and not of a new growth. Schutze²⁴ has described a rare specimen, in which the cervix was the seat of an adenocarcinoma; a diffuse adenomyoma of the uterus was present, and distributed more or less diffusely throughout the latter tumor and especially involving its connective tissue were many typical tubercles. Many psammoma-like bodies were present in the wall of the uterus. Dickson²⁵ has observed a specimen of uterine adenomyoma invaded by tuberculosis. Multiple myomata were present and all but one of the tumors presented a number of cheesy necrotic areas, the largest of these having a diameter of 5 cm. Two small subperitoneal tumors were converted into white, necrotic material with a consistency of putty. Tuberculosis of the tubes and endometrium was also present. Kelly²⁶ remarks upon the extreme rarity with which tuberculosis is found complicating large myomatous uteri. Heinrich,²⁷ and Violet and Perrin²⁸ have reported the histories of such cases. Grunbaum²⁹ has described a case of a large uterine adenomyoma, in which the tumor tissue was permeated with small tubercles. The myometrium contained many tuberculous foci undergoing cheesy degeneration. Tuberculosis of the endometrium and lungs was also present. Grunbaum believes the infection was a hemogenic one to the endometrium and from thence by direct extensions to the tumor.

Archambault and Pearce³⁰ report the history of a case in which an adenomyoma of the uterus showed typical tubercles. One tube was the seat of a tuberculous salpingitis, the other tube and the endometrium were normal. A pulmonary tuberculosis was also present. The authors believe a direct hemogenic infection from the lungs occurred, and that this case was not therefore the result of a spread from the endometrium, as is usually the case in these specimens. Kelly and Cullen³¹ have also recorded a case of an adenomyoma of the uterus invaded by a tuberculosis. The tubes showed advanced tuberculous salpingitis. These authors report another case of tuberculosis of the uterus associated with a myoma.

Grad³² has recorded the history of a case in which there was a bilateral tuberculous salpingitis and an ovarian cyst. The latter sprang from the right ovary and the tuberculous tube was drawn out and adherent over the surface cyst. Pewsner,³³ Logothetopoulos,³⁴ Prussmann,³⁵ Polloson and Violet,³⁶ Meriel,³⁷ and Poncet and Leriche³⁸ have described cases in which ovarian cystadenomata were invaded by tuberculosis. Poncet and Leriche go so far as to say that they believe tuberculosis to be a definite etiologic factor in the production of certain cystic tumors of benign type. They call attention to the frequency with which latent tuberculosis is found in patients who have goiter, and cite the works of several authors who have shown by histologic examination that simple goiters are often tuberculous. They believe that adenomatous proliferation is one of the ways in which the thyroid reacts to tuberculosis. They state that cysts of the ovary showing no specific tuberculous lesions are frequently found in connection with tuberculosis of the fallopian tubes. A number of cases are cited. They conclude that these are due to inflammatory tuberculosis of the ovaries, which react to the tuberculous process by the formation of cysts. They do not imply that all ovarian cysts are the result of tuberculosis, but think tuberculosis is one of the causes.

That tuberculosis may produce cystic lesions is well recognized, but perioöphoritis is a frequent condition and actual tuberculous oöphoritis is more frequent than formerly supposed. Both these conditions may lead to the formation of retention cysts, but that cystadenomata or other forms of true new growths are the result of tuberculosis, or even that the presence of tuberculosis predisposes to the formation of ovarian neoplasms is certainly far from proven. As has been stated, a study of our material in the laboratory of gynecological pathology at the University of Pennsylvania and of the literature pertaining to this subject does not seem to the author to bear out the assertion that ovarian neoplasms showing tuberculous invasion are more frequent than can be explained on the grounds of the purely accidental combination of these conditions. Furthermore, this opinion is strengthened by a study of the histology of these tumors.

To summarize, it may be stated that the etiologic relationship between cancer and tuberculosis is not definitely proven, but preëxisting inflammation is apparently at least to some extent an etiologic factor. Carcinoma of the fallopian tube is in itself an infrequent tumor, but its relative frequency occurring with tuberculosis is at least suggestive. The assumption of Von Franque¹¹ that the tumor rarely springs from the area actively affected by tuberculosis must be taken with some reservations. Tuberculosis affecting the fallopian tubes usually begins in the

ampulla, and this portion of the tube usually presents the most characteristic histologic picture of the infection. We believe, however, that in most cases where the disease is moderately advanced, at least all or nearly all the mucosa of the tube is involved, and the fact that, in a given specimen, tubercles were not found near the uterine end is no proof that this part of the tube had not been invaded to some extent. Filiomyomata are rarely attacked by tuberculosis, whereas adenomyomata are frequently invaded by a direct extension from the mucosa and less rarely by a hemogenic or lymphatic infection. Ovarian cystadenomata, when occurring in conjunction with peritoneal or pelvic tuberculosis, are frequently attacked; usually only the capsule of the tumor being involved, less frequently and as a result of long standing or virulent infections or occurring perhaps as a result of a hemogenic or lymphogenic infection, the substance of the tumor is invaded. In all cases care must be observed to differentiate between the pseudoneoplasm, which may be produced by tuberculosis alone, and true tumor.

Tuberculosis of the Uterus Causing Pyometra.—It is generally conceded that pyometra rarely occurs except in cases of malignancy. In a few instances, however, this condition has been observed in conjunction with tuberculosis, most frequently with tuberculosis of the cervix, although occasionally an extensive corporeal endometritis may result in shutting off of the cervical canal and the consequent formation of a pyometra. Targett³⁹ presents an illustration of a pyometra, the endometrial cavity being much dilated and the myometrium markedly thinned. The endometrium was reddened and presented many small punctate ulcers, most of which were superficial. The abstracted reports of a number of cases of pyometra, the result of cervical tuberculosis, are presented elsewhere. Schiffmann⁴⁰ reports the history of an interesting case in which a woman, who had never menstruated or been pregnant, presented herself suffering from tuberculous adnexitis. An operation was performed and the patient died of a purulent peritonitis. A postmortem showed that she had suffered for years, probably since childhood, from a tuberculous metritis, which had resulted in occlusion of the canal and which accounted for the amenorrhea.

Torsion of Tuberculous Tubal Lesions.—Tuberculous pyosalpinges are subject to the same accidents, as are similar pathologic processes the result of microorganisms other than the tubercle bacillus. Indeed, torsion is perhaps more frequent in tuberculosis than in other forms of pyosalpinges. Anspach⁴¹ has especially emphasized this point. The tendency of tuberculosis of the fallopian tubes to produce large retort shaped lesions, often comparatively free from adhesions, and the

extreme chronicity of the disease, are all factors which make torsions more likely to occur. The fact that the ovaries are less likely to be severely attacked in tuberculosis than in other forms of pelvic infection, thus theoretically lessening the extent of the adnexal adhesions, may also be a factor in the somewhat more frequent occurrence of torsion in tuberculosis than in other varieties of infection of the fallopian tubes. Fortunately, torsion, even in tuberculous cases, is a rare complication. Hydrosalpinges are, by reason of their frequent retort shape and often relative freedom from adhesions, more prone to torsion than are actual pus producing lesions. The exact etiology of torsion of inflammatory uterine adnexa is difficult to determine, but is probably largely influenced by the same factors as are known to produce so frequently similar accidents in cases of ovarian neoplasms. Among the causative agents, therefore, are length of pedicle, irregularity in shape of the tumor, flaccidity of the abdominal walls, alternative filling and emptying of the bladder and rectum, peristaltic movements of the intestines, and rapid alternations in the intra-abdominal pressure, such as are produced by pregnancy, labor, paracentesis abdominis, alternate distention and evacuation of the intestines, sudden, unusual or constrained movements of the body as a whole, such as stooping, turning to get out of bed, vomiting, trauma, falls, jolts, administering of enemata, gynecologic examinations, and pressure of the abdomen against a hard object, such as a wash tub, etc.

Bell⁴² lays particular stress upon the action of the diaphragm in these cases. Payr⁴³ has directed attention to another, and which he believes to be an important factor in the production of torsion. This author believes that venous stasis in the pedicle, especially of small freely movable tumors, may cause them to twist. The veins in many such pedicles are extremely tortuous, much more so than the arteries, and, as a result of intense congestion, impart a spiral motion to the tumor; as twists occur the stasis becomes increased and a sort of vicious circle is formed. Payr's article contains a number of illustrations. The ovarian veins are normally unusually tortuous, so that the foregoing theory is particularly applicable to torsion of inflammatory tumors of the adnexa.

SYMPTOMS.—Torsion of the inflammatory tube, like torsion of ovarian neoplasms, may be acute, the twist more or less completely shutting off the blood supply and resulting in gangrene or rupture; or it may be chronic, causing a disturbance of the blood supply and a mild exacerbation of the symptoms, followed by a remission, and later followed by other twists, any of which may be acute. Any degree of variation

between these extremes may occur, the symptoms usually depending upon the degree of torsions and impairment of circulation.

A previous history of pelvic inflammatory disease is usually present. Not infrequently a history of some causative factor may be obtainable, although sometimes this is absent. In 63 per cent of the recorded cases of torsions due to all forms of infections, the patients have been kept under observation for a time before operation, showing that in a definite proportion the symptoms at the onset were not very alarming. Many of these cases were at first mistaken for exacerbations of a pelvic inflammatory disease. The seizure is almost invariably ushered in by an attack of severe sharp pain over the seat of the lesion. This is accompanied by more or less marked symptoms of shock or collapse, followed shortly by the evidence of acute pelvic peritonitis, which not infrequently becomes general; nausea, vomiting, hyperpyrexia and elevation of the pulse rate, with the accompanying evidence of peritonitis, develop. Vesical disturbances, such as retention of urine or irritability and frequency of urination, are frequently observed. Examination reveals the presence of a more or less tender, fluctuant tumor, which is generally pelvic in location. In cases in which a pelvic examination has been made prior to the attack, the change in shape, size and consistency of the tumor will be of aid in arriving at the correct diagnosis, as, subsequently to the torsion, the tube becomes larger, more tender and more tense, and possesses a somewhat more limited range of mobility. The enlargement is sometimes quite marked. The opposite adnexa are usually found to be the seat of an inflammatory lesion. A satisfactory pelvic examination can rarely be performed without an anesthetic, owing to the tenderness and rigidity which is generally present.

DIAGNOSIS.—The correct diagnosis of torsion of an inflammatory uterine appendage is extremely difficult and rarely made (Bell,⁴² Anspach⁴¹). For practical purposes, however, the character of the symptoms and the local findings are nearly always sufficient to call for immediate operative intervention in the severe forms. The condition is frequently mistaken for a torsion of a small ovarian cyst or, when upon the right side, for an acute appendicitis. An important point is to determine between the lighting up of a previously chronic inflammatory condition and a torsion or twisted hydrosalpinx. If a hydrosalpinx undergoing torsion is mistaken for an ovarian cyst or an acute appendicitis, no great harm is done, as both require immediate surgical intervention. If, however, the condition is mistaken for an exacerbation of a previously existing pelvic inflammatory disease, much valuable time may be lost and a general peritonitis develop. The history of Anspach's

case is as follows: Age, 26; symptoms, simulating acute appendicitis. Operation revealed a long, retort shaped right tube containing blood and pus, twisted two and one half times in the direction of the hands of a watch. Salpingo-oöphorectomy was performed. Recovery. Subsequent to the operation the patient complained of pain in the left ovarian region, and a few months later a second operation showed a similar shaped fallopian tube on the left side. Microscopic examination proved the latter to be tuberculous in origin. The origin of the infection in the right side was probably similar, but this point could not be positively determined because of the dense infiltration with blood and numerous hemorrhagic infarcts, which were present, incident to the torsion. Von Meerdervoort ⁴⁴ has reported a case occurring in a patient 24 years of age. Symptoms of pelvic disease and pain in the lower abdomen had been present for 5 years. At operation bilateral suppurative tubal lesions were found; the right tube was the seat of a torsion. Histologically, both pyosalpinges proved to be tuberculous in origin. Ross ⁴⁵ has reported the history of a case in which the symptoms appeared suddenly after cranking a motor car. The diagnosis before operation was acute appendicitis, and an emergency operation was performed. Both tubes were found to have been converted into tuberculous pyosalpinges and the right was twisted. Sampson ⁴⁶ has also recorded the history of a case occurring in a patient 21 years of age. The attack was sudden in onset and simulated the symptoms produced by the torsion of an ovarian cyst. Operation revealed bilateral pyosalpinges, with torsion of the right tube. Supravaginal hysterectomy, bilateral salpingectomy, and right oöphorectomy was performed. Histologic examination proved the tuberculous origin of the inflammation.

TREATMENT.—Immediate operative intervention is required in all cases of torsion.

Rupture of Tuberculous Pyosalpinges.—This is a comparatively rare accident, but may occur to any pyosalpinx. As a result of adhesions to surrounding structures the tubal contents may be discharged into the intestinal tract, bladder, uterus, peritoneal cavity, or even through the abdominal wall. Rupture is most likely to occur into the rectum or sigmoid flexure or into the peritoneal cavity. The latter is the form of rupture usually meant by most writers when the term "rupture of a pyosalpinx" is referred to. Ruptures may occur spontaneously or may be the result of direct trauma, such as blows, kicks, falls, rough pelvic examinations, coitus, or labor; violent peristalsis, straining at stool, may also in certain cases produce rupture. It is probable that, if pelvic inflammatory disease did not usually produce sterility, rupture during preg-

nancy or labor would be much more frequent. As the growing uterus rises out of the pelvis to which inflammatory tubes are densely adherent, considerable traction is sure to be caused. A drawing out and thinning of the tube follows, which, if in itself it does not cause rupture, produces a lesion by the aid of which a small amount of trauma is sufficient to produce the accident. Indeed, under such conditions Gonsolin⁴⁷ states that tubes, both ends of which are patulous, may rupture as a result of traction. Labor itself may cause rupture. Bovee⁴⁸ in 1910 collected statistics from fifty-five cases of rupture without reference to the type of infection, and submitted a history of an additional case from his own practice. In the majority of the ruptured cases there was no assignable cause for the rupture. Undoubtedly the acute exacerbations of chronic lesions tend to produce a condition favorable for rupture, as at these periods more secretion is excreted into the closed off tube, resulting in an increase of intratubal pressure, and the acute inflammation tends to weaken the abscess walls. Rupture usually takes place in the ampulla of the tube. No rule can be formulated as to the size of a pyosalpinx in which rupture is most likely to occur. In many of the reported cases the tubes have been small. Naturally, those specimens in which the walls are thin and friable are most prone to this accident. Adhesions in some cases probably play an important part.

SYMPTOMS.—These vary widely in different cases, depending upon the virulence of the organisms and the locality into which the pus escapes. A previous history of pelvic inflammatory disease is generally obtainable. In twenty-nine of thirty-one cases of rupture into the peritoneal cavity, without regard to the type of infection, collected by Bonney,⁴⁹ in which an accurate history was obtainable, the onset was abrupt and violent and the evolution of the symptoms rapid. At the time of accident a sharp pain at the site of the rupture generally occurs, usually followed by nausea and vomiting. The temperature may be normal or subnormal for a few hours, and the pulse rapid and weak; pallor, sweating, and other symptoms suggestive of an internal hemorrhage are frequent. The temperature soon rises and other evidences of a general peritonitis become manifest. The disproportion between the pulse rate and temperature in the early stage, together with the history of sharp pain perhaps occurring during straining at stool, trauma, etc., followed rapidly by the evidences of peritonitis, are very suggestive of this accident.

DIAGNOSIS.—If a pelvic examination has been made prior to the rupture, examination subsequently will reveal the altered shape of the tube, which is found collapsed and flaccid, whereas previously it may have been easily defined as a tense inflammatory mass. From a practical

standpoint, however, this test is of little value in the average case, because, even if the surgeon has made a pelvic examination prior to the rupture, the rupture itself is likely to produce so much pain and tenderness that, on examination shortly after the accident, accurate outlining of inflammatory masses is extremely difficult or impossible without the aid of an anesthetic. One of the chief dangers from the rupture, as well as from torsions, is that the accident may be mistaken for a simple exacerbation of a previous inflammatory disease and therefore treated palliatively. In both these conditions it is of the utmost importance that operative measures be employed without delay. The fact that the degree of mortality bears a direct ratio to the time elapsing after the accident and before the operation is amply proven by Bovee,⁴⁸ Bonney,⁴⁹ Boldt,⁵⁰ and all others. In these cases, the aim of the surgeon should be to make the diagnosis and operate before the onset of the general peritonitis, which is almost sure to follow a rupture into the general peritoneal cavity. The previous history of the case, the acute onset, are usually sufficient to exclude the ordinary exacerbation of a pelvic inflammatory disease. When the lesion is on the right side, not infrequently these cases have been mistaken for an acute appendicitis. Torsion or rupture of an ovarian cyst may also be readily confused with this condition. Fortunately these conditions require immediate operative intervention, so that a mistake in diagnosis under such circumstances is not of vital importance.

TREATMENT.—As previously stated, the treatment should be immediate operation. The type of operation employed will naturally vary with the individual case.

Rupture of a Pyosalpinx into Adjacent Hollow Viscera.—According to statistics this is probably a more frequent accident than is generally thought, and doubtless its diagnosis is often overlooked by the keenest observers. The opening may be direct into the bowel or may be indirect, the tubal opening leading into the bowel through a walled off fistular tract. The former is the more frequent. In a series of tubal cases operated upon in the University Hospital in the last ten years, a number of cases of this kind have been observed, and, in all, ruptures had taken place between the tube and the lower large bowel. In all the point of rupture occurred in a portion of the tube which was adherent to the intestine and no general peritoneal involvement had occurred. Tubal abscesses of tuberculous organs are perhaps more prone to this accident than are like conditions, the result of other types of infection.

The rupture of a pyosalpinx into the bladder is less frequent than into the bowel, probably because, owing to the anatomic situation of

the tube, vesical adhesions are less frequent than are similar lesions to the bowel. Violet and Chalié⁵¹ believe that this is not an uncommon condition. They state that the opening into the bladder may be direct (tubovesical) or indirect (peritoneovesical), a soft, caseous mass intervening between the tube and bladder. The former is the more frequent. Under such circumstances the resulting cystitis and the recovery of tubercle bacilli from the urine may lead to a diagnosis of renal infection, unless a careful cystoscopic examination is performed. Kutschner⁵² has described a case of this character, in which a tuberculous pyosalpinx perforated into the bladder and simulated bilateral renal tuberculosis. Israel⁵³ reports the history of a similar case. The patient was a young woman suffering pain, failing health, loss of weight, night sweats, fever, dysuria and pyuria. On the first urine analysis tubercle bacilli were demonstrated; in the next two examinations no tubercle bacilli were found.

Cystoscopic examination revealed the presence of a cystitis and a tuberculous ulcer on the right side of the bladder. Both ureters were catheterized and tubercle bacilli were demonstrated by animal inoculation from each. A second catheterization was performed with the same results. The diagnosis of bilateral renal tuberculosis was made, and an unfavorable prognosis given. The patient was sent to a sanatorium; 11 months later she presented herself apparently in perfect health, having gained 38 pounds. Cystoscopic examination at this time showed a cystitis, but the ulcer had disappeared. Renal palpation was negative. An examination under ether revealed a mass situated to one side of the uterus. The examination was followed by hyperpyrexia and pelvic pain, which persisted for a day or two. A few days later another urethral catheterization was performed, special care being taken to avoid contamination of the catheters in the bladder. Normal urine was obtained from both sides. The diagnosis was now clear. Abdominal section showed a tuberculous pyosalpinx, the lumen of which communicated with the interior of the bladder by a hollow band four or five centimeters long. Following the operation the pyuria disappeared, but tubercle bacilli continued to be present in the vesical urine for six months. The patient was reported well two years later. This case illustrates the necessity for a thorough pelvic examination in all cases, and illustrates also how easily the most experienced may be misled by such findings as reported above.

Aurray⁵⁴ has described three somewhat similar cases. He states that tubovesical fistulas rarely heal spontaneously. Violet and Chalié⁵¹ report the histories of three cases of this kind and urge the necessity for

operation in such cases, recommending that generally an abdominal hysterectomy and bilateral salpingo-oöphorectomy be performed. The portion of the bladder surrounding the fistulous opening should be excised and the bladder closed. Vaginal drainage is indicated in most cases of rupture.¹

Extension of Tuberculosis from Pelvic Lesion to Other or Distant Areas.—In a previous chapter the extreme rarity, but occasional occurrence, of primary genital tuberculosis has been pointed out. If it is accepted that primary genital tuberculosis exists, it therefore follows that extensions from such a focus may occur. This, however, is more theoretic than practical, because of the rarity of primary genital lesions. Under certain circumstances, such as loss of continuity of the vaginal mucosa, or chemical irritation, either local or distant tuberculous lesions may be produced by the introduction into the vagina of virulent tubercle bacilli. It is of importance to recognize that distant lesions, such as pulmonary tuberculosis, etc., may in rare instances be thus produced. It should, however, be emphasized that such results only occur under special conditions which favor infection, and are by no means the rule.

As has been stated in the résumé of primary and secondary genital tuberculosis, what frequently does occur is that there is a well marked secondary genital lesion, and the primary lesion in the lungs or elsewhere has undergone partial resolution, or is of such small size that its clinical demonstration is almost impossible with any degree of certainty. In these cases it seems probable that an active pelvic lesion may be the focus for an extension of the infection, even to a distant part of the body; and especially is this true if operation is performed, as the trauma may open up avenues for infection and break up what formerly were walled off collections of infectious material. Brett⁵⁵ has described a case of miliary tuberculosis which he believes had its origin from a tuberculous metritis. It seems likely that occasionally a spread of infection to distant portions of the body may occur as a direct result of an operation for genital tuberculosis.

Tuberculous Lesions in Hernial Sacs.—The fact that tuberculosis of the adnexa usually produces adhesions which in themselves tend to prevent the inflammatory structures from entering hernial sacs by limiting the range of mobility is one of the chief reasons for the rarity with which diseased tubes and ovaries are found in hernial sacs. Cullen,⁵⁶

¹ A more extensive résumé of the subject of torsion and rupture of inflammatory uterine adnexa, without regard to the type of infection, may be found in the author's previous work, "Gonorrhea in Women," Phila. and London, 1913, pp. 319-355. This includes literature and an abstract of cases.

Göpel,⁵⁷ Le Nouene⁵⁸ have recorded instances where inflammatory adnexa were discovered in hernial sacs. In none of these cases is the type of infection definitely stated. Constantini⁵⁹ has described a case of tuberculous infection actually invading an inguinal hernia, in a woman 40 years of age. Morrison⁶⁰ has also recorded the histories of a series of cases in which tuberculosis occurred within hernial sacs. He states that in the Royal Hospital for Sick Children, Edinburgh, tuberculosis was present in 2 per cent of all herniae. The condition is much more frequent in children than in adults. In 1906 Cotte,⁶¹ in a study of a series of such cases, found 25 per cent occurred in children under 5 years of age. Either the hernia or the tuberculosis may be the primary lesion, the former being the most frequent. Jennesco⁶² believes that the tuberculosis within the hernial sac generally precedes the abdominal tuberculosis, and not vice versa, as might be supposed. Morrison,⁶⁰ however, believes the latter condition the most frequent, and states that there is no postmortem record which shows abdominal tuberculosis absent when present within the hernial sac. He further points out that abdominal tuberculosis is sometimes difficult to recognize and may, therefore, be overlooked. The occurrence of tuberculosis in hernial sacs may be viewed as purely accidental, and is of interest chiefly on account of its rarity.

The interior of the sac may present any of the changes common to tuberculous peritonitis, the variety in most cases corresponding with that present within the abdomen. The most frequent variety is that in which the peritoneum is thickened, congested, and studded with grayish tubercles. Perhaps, as a result of gravity, the fundus of the sac is prone to be the area chiefly attacked, although in some recorded specimens the chief changes have been present in the neck of the sac, evidently as a result of a direct extension from within. The sac frequently contains more or less fluid, the characteristics of which vary with the type of the peritonitis present. In some of the recorded cases the peritoneum of the hernial sac has been literally covered with tuberculous granulations, and in others the caseous or the fibrinous variety has been observed. In some specimens the interior of the sac has been filled with an almost indistinguishable mass, macroscopically resembling cicatricial tissue. Adhesions between the peritoneum and the other coverings of the hernia are frequent, and as a result these herniae are often irreducible. Morrison⁶⁰ states that in the Children's Hospital at Edinburgh 75 per cent of the children coming for treatment suffer from some form of hernia. This author states that in his series it was impossible to demonstrate abdominal tuberculosis by clinical methods in more than 36 per cent of cases

in which the infection was present in hernia. The end results in Morrison's series showed that 3 (11 per cent) of the 27 cases died of tuberculosis, and 3 more were seriously ill at the time of writing. The prognosis is, therefore, grave.

Maylard⁶³ directs attention to the fact that the symptoms of the tuberculosis are often subservient to those of the hernia. He cites a case occurring in a child 2 years of age, in which the tuberculosis was discovered accidentally when operating on the hernia. Similar cases have been recorded by Wallace,⁶⁴ Kennedy,⁶⁵ and Owen.⁶⁶ In these cases the symptoms of peritonitis were mild and the existence of infection might not have been discovered except for the operations which were performed for the hernia. Maylard⁶³ states that the infection in his case might have subsided and its presence never have been known, but for the hernia which required operation.

Tuberculosis and Syphilis.—Whether the occurrence of these two types of infection is purely accidental, or whether the one in any way predisposes towards the other, is still somewhat undetermined. Pick and Bandler⁶⁷ state, in presenting a series of cases studied by them, that 31 per cent of the deaths of these syphilitic patients were due to tuberculosis.

Tuberculous Wound Infection.—This is by no means of rare occurrence, and is particularly likely to occur when drainage is employed and tuberculous material left behind. An instance of this type of infection is often observed in the fistulas following nephrectomy for tuberculosis of the kidney. Occasionally the same thing occurs after operation for tuberculous peritonitis or adnexitis. A rare complication is that observed by Edebohls.⁶⁸ This author operated upon a patient for bilateral tuberculous pyosalpinges. A miliary tuberculosis of the peritoneum was present. The wound healed satisfactorily, but subsequently a tuberculous infection of the cicatrix developed, which required a second operation.

Tuberculous Salpingitis as an Etiologic Factor in Tubal Pregnancy.—The fact that salpingitis is a frequent etiologic factor in the production of tubal gestation is well known. Fehling⁶⁹ reports the results obtained in 170 cases of early extra-uterine pregnancy, in nearly half of which, when a careful examination was possible, the opposite adnexa were found diseased. Cones,⁷⁰ in an analysis of 202 cases of ectopic pregnancy, found that 83 per cent were accompanied by inflammatory lesions. The author⁷¹ found 59 per cent of a series of 64 cases to have been preceded by inflammation. Numerous other statistics could be quoted bearing out the etiologic relationship which exists between preëxisting salpingitis and tubal pregnancy. As tuberculosis constitutes a definite proportion of all tubal infections (about 7 per cent), it is but

natural to expect to find it a not infrequent etiologic factor in the causation of tubal pregnancy. The facts that tuberculosis of the tubes is usually bilateral, chronic in character, and that in this type of infection the tubes tend to remain patent longer than in the ordinary forms of infection, all are points which make the likelihood of tubal implantation of the gravid ovum likely in this variety of infection. Croom⁷² has reported the history of an advanced extra-uterine pregnancy complicated with not only a tuberculosis of the tubes, but also of the peritoneal cavity.

Appendicitis and Tuberculosis.—Silvestri⁷³ found manifestations of tuberculosis in 45.63 per cent of 103 persons with appendicitis. Periapendicitis, as an accompaniment of tuberculous salpingitis or peritonitis, is frequent and has occurred in a large percentage of our cases.

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CHAPTER XI

PREGNANCY AND TUBERCULOSIS

History—Fertility of the tuberculous—Frequency—Physiology of pregnancy bearing on course of tuberculosis—Organs affected—Puerperium and its bearing upon course of tuberculosis—Susceptibility of pregnant women—Strain of lactation.—Condition of children of tuberculous mothers—Infant mortality—Influence of pulmonary tuberculosis on course of pregnancy—Influence of pregnancy on course of pulmonary tuberculosis—Tubercle bacilli in mother's milk—Tuberculin as diagnostic and curative agent—Law regarding marriage of tuberculous persons—Indication for induction of abortion prior to fifth month—Results—Consultation and precaution prior to induction of abortion—Choice of operation—Sterilization—Anesthetic—Technic of operation (during first two months)—Convalescence—Technic and choice of operation for emptying uterus from second to fifth month—Pregnancy after fifth month—Delivery of tuberculous patients—Cesarean section—Puerperium, treatment during, nursing—Influence of pregnancy upon tuberculous lesions other than the lungs—Bibliography.

HISTORIC

From the early ages the subject of pregnancy in tuberculous patients has attracted marked attention. Among the early papers devoted to this subject are especially noteworthy the contributions of Horn,¹ Succow,² Herrieux,³ Robert,⁴ Grisolle,⁵ Dechambre,⁶ Tott,⁷ Dubreuille,⁸ Lasségue,⁹ Warren,¹⁰ Thomas,¹¹ Caresme,¹² and of Ortega.¹³ The latter is a report of 132 pregnancies, of which 95 went to term, 28 were premature, and 9 aborted. Third pregnancies were rare. Ortega believed pregnancy exerted a deleterious influence on the course of the tuberculosis. Other interesting contributions to this subject exist, reference to many of which may be found in the article of Malsbary,¹⁴ from which much of the foregoing information has been obtained.

In reviewing the early literature of pregnancy in the tuberculous, it is interesting to find that pregnancy was for many years believed to exert a favorable influence on the course of pulmonary tuberculosis. This is probably due to the fact that gestation tends somewhat to increase the weight of the woman. This is, however, generally only temporary, and after the fifth or sixth month rapid advancement of the disease is likely to occur. As early as 1862 Gassner¹⁵ commented upon this finding. The

increase in weight occurs chiefly in the latter months of pregnancy, the normal gain being from 1600 to 2500 grams a month (from 3 to 5 pounds). According to De Lee,¹⁶ the increase in weight is due to increased assimilation of the fetus and the secundines, the storing up of fat and albumin, the accumulation of water, especially in the lower extremities, and increase in the amount of blood. When pregnancy occurs in the tuberculous woman, very frequently, even in those cases in which pregnancy ultimately exerts an unfavorable influence, no deleterious results occur, or at least become manifest during the early months of gestation.

Fertility in the Tuberculous.—No practicing physician can have failed to observe the frequency with which pregnancy occurs in the tuberculous. This fact has led many observers to conclude that persons affected with tuberculosis are unusually fruitful, and that, as a result of the disease, the sexual appetite is increased. Numerous observations have been recorded to bear out this assertion. Sexual intercourse is often practiced even by those in whom the disease is advanced. Simmonds¹⁷ has reported a case in which a man had intercourse with his wife on the day on which he died from an advanced pulmonary tuberculosis, and numerous other somewhat similar instances have been recorded. The fact that, as the result of treatment, many tuberculous patients are idle may have some bearing on the increased sexual desire. Posthumous children are frequent among the tuberculous. Be the reasons what they may, it appears to be certain that tuberculosis, even when moderately advanced, does not materially decrease the sexual appetite nor interfere with fertility. Cornet¹⁸ quotes a number of cases in which the sexual appetite was apparently increased in the later stages of tuberculosis, but does not accept these as proof of an increased sexual appetite; he believes that, because of bizarre nature, observers are unduly impressed by them. He holds that, in the majority of cases, as the disease progresses the sexual desire is diminished. However this may be, the fact remains that pregnancy in tuberculous women is of extremely frequent occurrence, and, as stated, it seems to be an assured fact that the disease itself exerts little or no influence on conception.

Tuberculosis itself is essentially a disease due to faulty hygiene; the latter is the most common among the ignorant and poor, a class in whom fertility is notorious. Although the fertility among the poor is probably largely the result of ignorance regarding the methods of preventing conception, the fact remains that pregnancy and tuberculosis frequently co-exist.

FREQUENCY.—In 1913 Bacon¹⁹ stated that 32,000 tuberculous women

become pregnant annually in the United States, and that between 44,000 and 48,000 women of the child bearing age die of tuberculosis every year. Probably 25 per cent of the latter have reached the puerperal state, or, in other words, 11,000 or 12,000 tuberculous pregnant women die annually. This writer believes that 33 per cent of pregnant tuberculous women die in less than one year following labor. He points out that these data show only a part of the important bearing which pregnancy has upon tuberculosis. Besides an increased mortality among tuberculous pregnant women, the latter are a source of infection to the family and an important factor in the spread of the disease.

The Physiology of Pregnancy as It Bears Upon the Course of Tuberculosis.—The deleterious influence of pregnancy on tuberculous women is well known, and many theories have been advanced to explain this fact. During pregnancy the woman carries a double load, and, as the gestation advances, the drain upon her strength becomes more and more marked. Although pregnancy is a physiologic process, and one that the healthy woman is well able to bear, when it occurs in a patient whose resisting powers are weakened by disease, the extra stress may be sufficient to overbalance her resistance, and, as a result, the disease may progress rapidly in a woman who had heretofore held her own, or who had even been successfully combatting her infection. This is true of all diseases, but especially is it so of tuberculosis. Many of the physiologic changes that occur as the result of pregnancy, and that are commonly pointed out as the cause for the injurious action of pregnancy hardly appear of sufficient importance during the early stages to account for the rapid progress of the disease frequently observed at this period. The author believes that further study of this subject is required to explain why so many cases of early pregnancy show an exacerbation of the tuberculous condition.

Some of the physiologic reasons commonly referred to as exerting a deleterious influence on pregnancy, and which are doubtless important factors in the latter months of gestation, are the following:

LUNGS.—During the latter months of pregnancy a change occurs in the shape of the lungs, although their capacity is but little altered; the organs become shorter and broader as the result of upward pressure of the gravid uterus; the diaphragm is pushed up, and the lungs are somewhat retracted to the sides, thereby exposing a larger part of the heart. These changes are more marked in primiparae than in multiparae, the abdominal walls in the latter being lax. Respiration becomes more of the costal type, owing to restriction of the movements of the diaphragm. The respiratory rate is increased—from 24 to 26 a minute—and more

carbon dioxid is excreted (Vejas²⁰). During the last two weeks of pregnancy, when "lightening" has occurred, the foregoing phenomena are less marked. In the late months of pregnancy the condition just described may in all justice be pointed to as an etiologic factor in causing aggravation of the pulmonary disease. But in the early months of gestation this is not the case. During the strain of labor more or less congestion of the lungs occurs. It can readily be understood how such straining efforts may exert a deleterious effect upon pulmonary lesions.

LARYNX.—The frequency with which laryngeal involvement occurs in the pregnant tuberculous woman has been commented upon by most observers. Malsbary¹⁴ has suggested that some relationship may exist between this and the so-called "genital spot." Bretteuer has called attention to the relationship between the "genital spot" and dysmenorrhea. Hofbauer²¹ has demonstrated that, as a result of pregnancy, there is an increased congestion of the larynx, affecting especially the false vocal cords, and that there is also a slight cellular infiltration of the tissue in this location. Hofbauer also states that, in the normal pregnant woman, the mucosa of the larynx becomes reddened and swollen, so that a step from the physiologic to the pathologic is not unlikely.

CIRCULATORY SYSTEM.—*Heart*.—It was formerly believed that, as the result of pregnancy, the heart became hypertrophied. Stengel and Stanton²² showed that this was not the case, and that the increase in dullness to the left was not the result of hypertrophy of the left ventricle, or of any special increase in work, but that it was caused by the upward and outward displacement of the organ. These observers state, however, that in labor there is probably some dilatation of the right ventricle, but they believe that there is no material change in the blood pressure prior to or following labor. De Lee¹⁶ asserts that in 25 per cent of cases a systolic murmur is present over the base of the heart. Norris²³ is of the opinion that the displacement of the heart tends to cause a kinking of the large vessels, thus adding to the work demanded of that organ. Wiessner²⁴ believes that this explains the occurrence of accidental pulmonary murmurs. Norris states that in normal pregnancy the blood pressure rarely exceeds 120 mm. of mercury and, if taken between pains in the second stage of labor, it varies between 130 and 150 mm. After delivery the normal values are established.

During the uterine contractions of active labor the pains, as well as the intra-abdominal compression, cause a much higher blood pressure than is present in the interim between the pains. Heynemann²⁵ observed a fall of from 60 to 90 mm., following the birth of the child.

During the early months of pregnancy many ill nourished women,

and especially those in poor circumstances, suffer from a form of chloranemia (De Lee). The condition is very frequent among the poorer classes of phthisical patients—"Virchow's physiologic leukocytosis." Dietrich²⁶ has in the main confirmed these findings.

The blood changes during pregnancy are not marked, and probably exert little influence on tuberculosis, except in those patients who are anemic and whose natural resisting powers are diminished as a result. As is well known, the ductless glands exhibit special activity during pregnancy.

DIGESTIVE TRACT.—More or less vomiting or nausea occurs in about 50 per cent of pregnant women. This is especially likely to occur in neurotic subjects, and during the early months of pregnancy. When violent straining occurs, the blood pressure is raised and unusual pressure is exerted upon the lung tissue. This condition must, therefore, be considered when the cause for the exacerbation of pulmonary lesions is sought. Brooks and Leuckhardt,²⁷ in their recent investigations, have shown that although vomiting does not always produce a marked increase in the blood pressure, sharp rises often occur. These investigators state that during the vomiting sudden and severe oscillations of the blood pressure are of frequent occurrence, and that these may cause rupture of a blood vessel that would not occur with the same degree of pressure but with slower changes. As the result of these studies, they also show that the danger to the vascular system during vomiting is not minimized, but that the responsibility is shifted from hypertension to the sudden variations in the condition of the circulatory apparatus. If the vomiting becomes so serious as to interfere with nutrition, its deleterious action on the course of the tuberculosis is most marked. All who have studied pulmonary tuberculosis agree that the phthisical patient requires an abundance of nutritious food. If sufficient food cannot be taken, or if assimilation is interfered with, a great handicap is placed upon the tuberculous woman.

KIDNEYS.—Throughout pregnancy there is a tendency toward renal disturbances, and lesions of these organs are subject to exacerbations. This is especially injurious to tuberculous patients.

OTHER CHANGES INCIDENT TO PREGNANCY.—Many other changes occur as the result of pregnancy, but a large part of these cannot be held responsible for the aggravation of the pulmonary lesions. Exactly why pulmonary tuberculosis is so prone to exacerbation during pregnancy is difficult to explain, except upon the broad ground that pregnancy in itself throws an added burden upon the general system, and that this may in some cases be enough to overthrow the balance of resistance on the part

of the patient. Hofbauer (quoted by Bandelier and Roepke²⁸) believes that the increased predisposition to tuberculosis in the pregnant woman is due to a reduction of the lipolytic quality of the serum with advancing gestation, hyperglycemia and certain physiologic causes, such as hyperemia, increased lymphatic flow, and peribronchial infiltration. Sergeant²⁹ suggests that the chlorosis, anemia, decalcification, excessive excretion of phosphorus, and adrenal insufficiency incident to the gravid condition, are determining factors. Davis³⁰ states that with the growth of the fetus a large part of the iron is appropriated from the mother's blood, and that this, together with the drain on the maternal calcium, are factors that tend to deplete the woman's strength. Davis also directs attention to the changes that take place in the ductless glands, and states that even in normal pregnancies 6 per cent of women suffer from hyperthyroidism. "It is a significant fact, at present not explained, that the Abderhalden test for early pregnancy gives a positive reaction in non-pregnant patients who have tuberculosis. Evidently the disturbances in the blood caused by pregnancy are closely allied to those of tuberculosis. It seems reasonable to suppose that the combination of these two conditions increases the pathologic condition." Friedrich's³¹ experiments upon rabbits did not show that lipidemia favored the dissemination of tuberculosis; in fact, they indicated the contrary.

Puerperium.—Fraught with more danger than pregnancy itself is the puerperium, and here a definite basis for the exacerbation of the tuberculous condition which so frequently occurs at this time can be determined. The patient has already suffered the strain of pregnancy, and has undergone whatever deleterious effects this exerted. The straining and increased blood pressure incident to labor are probably frequently sufficient to break down minute, partially healed pathologic processes, and thus convert closed lesions into open ones. As a result, hitherto partially or entirely encapsulated tubercle bacilli are liberated in more or less large numbers. Many free organisms are thrown into the blood stream, thus accounting for many of the cases of miliary tuberculosis that have been reported as occurring at this period. The actual physiologic exhaustion following a difficult labor is also a contributing factor in many cases. The congestion of the lungs incident to labor must likewise be taken into consideration. The prolonged muscular exertion, the physical exhaustion of labor, the possible loss of blood, or the effects of a general anesthetic, if one has been used, are also factors that must be taken into account.

Tuberculosis of the placenta has been described. It suffices here to state that tubercle bacilli have been found in the placentae of tuberculous

parturients by some observers in 40 per cent of cases. In the author's series, virulent tubercle bacilli were positively demonstrated in about 5 per cent of a series of cases comprising patients in various stages of the disease. Tubercle bacilli are prone to be present in the placenta of women suffering from an active lesion, and especially if hyperpyrexia or pyrexia is present. The organisms are much more likely to be present at term than in the immature placenta. Placentae containing tubercle bacilli may be, and frequently are, microscopically normal. In cases in which tubercle bacilli are present in the placenta it is but reasonable to suppose that organisms are also present in the decidua. If this theory is accepted, it follows that the contractions of the uterus incident to labor must force out a definite number of virulent organisms into the circulatory blood stream, and that, thus liberated, these tubercle bacilli may in turn set up new lesions and cause an exacerbation or the development of a miliary form of the disease. Von Bardeleben³² considers this so serious a cause for trouble that he recommends performing cesarean section and the excision of the placental sites prior to the onset of labor, for the double purpose of preventing the labor pains, which may squeeze out the organisms, and the removal of the possibly infected placental site. For the latter reason some operators recommend excision of the placental site and sterilization of the patient by ligation of the fallopian tubes, by partial or total salpingectomy, or by supravaginal or panhysterectomy, this being done for the purpose of preventing subsequent conception.

Another reason why exacerbations are so frequent during the puerperium is that lighting up of the pulmonary process has really started during the pregnancy, but has had time only to advance to such a stage as to attract definite attention by the time the puerperium has been reached.

LACTATION.—Lactation, particularly when the woman is below par, as most of the tuberculous are, is also a very definite added strain, and may in itself be sufficient to lower the woman's resisting powers to such a point as to exert an unfavorable influence on the course of the disease. As early as 1887 Hanau³³ pointed out the dangers of auto-infection. He asserted that the excessive straining, etc., induced expectoration, which was frequently drawn into hitherto uninfected pulmonary areas, only to set up fresh lesions there. The dangers of aspiration in such cases are undoubtedly real.

Susceptibility of Pregnant Women to Tuberculosis.—The author believes that, as a general rule, pregnancy, and especially the puerperium exerts an unfavorable influence upon the course of tuberculosis. Whether the normal pregnant woman is more susceptible to infection by the tubercle

bacilli is still an open question. It is certain that a definite proportion of women apparently contract the disease during either pregnancy or the puerperium. This is particularly true of the wives of tuberculous men living amid unhygienic surroundings. Whether this is due to an increased susceptibility at this period, or to the added strain on the general system is not known, but both are probably contributing factors. The change in the general routine of life incident to pregnancy, and the lessened amount of fresh air and lack of exercise indulged in by pregnant women may to some extent also be causative factors in some cases. Doubtless many cases in which the disease is apparently contracted during pregnancy are in reality exacerbations of hitherto mild and unsuspected lesions, and as the disease progresses, clinical symptoms become manifest, with the result that the condition is attributed to an infection occurring during pregnancy. Fishberg³⁴ found that, of 286 married tuberculous women, 107 or 37.4 per cent first noticed their pulmonary symptoms after one or more pregnancies had occurred. Jacob and Pannwitz,³⁵ in 337 tuberculous women, found that 25 per cent traced the origin or the exacerbation of their condition to pregnancy. Trembley³⁶ states that of 240 cases of tuberculous married women, 151, or 63 per cent, gave a positive history of the disease originating or becoming definitely recognizable either during pregnancy or the puerperium. Turban (quoted by Schauta³⁷) found that 29 per cent of tuberculous women who had borne children attributed the onset of their condition to pregnancy or the puerperium.

Funk,³⁸ in a series of 200 married women suffering from pulmonary tuberculosis, found that 30 per cent first noticed symptoms either during or shortly following pregnancy.

Grisolle⁵ observed that, in a series of 27 cases of tuberculosis in pregnant women, there were apparently many instances in which the disease developed during gestation. The average duration of the pulmonary symptoms in this series was 9½ months. Maragliano³⁹ found that 59 per cent of tuberculous women who had been pregnant first noticed severe symptoms during gestation or in the puerperium. Of 100 cases, Funk³⁸ found that in 43 the first symptoms of the pulmonary lesion became manifest during pregnancy or shortly afterward. The average age of these patients was 35.7 years. Combining these results, we find, in a series of 963 cases, 42 per cent first noticed the pulmonary symptoms during pregnancy or lactation.

The important points in the study of this condition are the prognosis and the treatment. Notwithstanding the frequency of these cases and the amount of study that has been devoted to them, comparatively few

valuable statistics have been formulated—too few, in fact, to permit the drawing of any hard or fast rules. The reasons for this are obvious, as so many factors enter into each case—the virulence of the infection, the stage of the disease, the type of infection, the resistance of the patient, her social standing, mode of life, ability and intelligence to submit to treatment, and the advancement of the pregnancy are all vital factors, to be considered in each case. Additional difficulties encountered in the compiling of statistics are that, with reference to the pulmonary conditions, special diagnostic skill is required, and even when this is had the most experienced may vary widely, since the personal equation enters largely into these cases. For present purposes, only broad statements will be made. In studying this subject, we cannot escape the fact that no fixed rule can be formulated that will apply to all cases, but that each case must be considered individually. All points bearing upon the individual case must be carefully weighed before a prognosis can be made or a line of treatment can be instituted. In considering the prognosis and treatment, a question that immediately arises in the investigator's mind, and in the minds of the prospective parents, is the probable condition of the child. Although this is only of secondary importance to the health of the mother, it is a point that must and should be definitely considered.

Condition of the Child of Tuberculous Mothers.—The subject of placental and congenital tuberculosis has been dealt with somewhat in detail in a previous chapter and only a brief review will be given here. It may be accepted that pregnancy or labor tends to produce a tuberculous bacillemia, and that, although this may be infrequent, as a result virulent tubercle bacilli may reach the placenta. The further the pregnancy is advanced, and the more active are the pulmonary lesions, the more likely is this to be the case. Tubercle bacilli are present in the placenta far more frequently than was formerly believed. The fact that virulent tubercle bacilli are present in the placenta is, however, no conclusive proof that a congenital infection exists. Although tubercle bacilli are not infrequently present in the placenta of tuberculous women, congenital tuberculosis is, nevertheless, an extremely infrequent disease, only 4 undoubted cases of this condition being recorded in the literature. Investigators have demonstrated that congenital tuberculosis may be produced in a small proportion of cases by animal experimentation, but even here the conditions can hardly be compared with those that occur in the pregnant woman, as the amount of culture of tubercle bacilli introduced into the pregnant animals is far in excess of what could possibly occur in the woman. It must be admitted, however, that congenital tuberculosis does occur occasionally in man, the condition being so rare, however, that for

practical purposes, it need not receive serious consideration. In nearly all children affected with tuberculosis the infection is a postnatal one.

The question as to whether or not the children of a tuberculous mother exhibit a greater or lesser susceptibility to this form of infection is of much greater importance, and is, unfortunately, still an unsettled point. Many convincing arguments may be arranged on both sides. The author believes that such children may show a hypersusceptibility to infection. This, however, is probably not marked. The number of tuberculous infants under one year of age who are the offspring of tuberculous parents would seem to be a strong argument in favor of this belief. Stutz⁴⁰ states that the children of tuberculous mothers are constitutional weaklings. The high mortality among these children is probably dependent more upon the unhygienic environment and often motherless condition to which these children are exposed, than to any hereditary predisposition. As has been stated, it is still a mooted point whether children of a tuberculous mother exhibit a hypersusceptibility to tuberculosis. The fact that the mortality among infants of tuberculous mothers is far greater than that among children of healthy progenitors has been substantiated, and should be taken into consideration when the question arises of performing the so-called "therapeutic abortion." Thus Sergent²⁹ states that 68 per cent of children of tuberculous mothers die. Parry⁴¹ is of the opinion that 50 per cent of these infants die during early months of life.

Pankow and Küpferle⁴² states that 54.5 per cent of these infants die under one year of age. Zirkel (quoted by Pankow and Küpferle) places the mortality at 58 per cent; Deibel⁴³ at 78 per cent; Weinberg (quoted by Pankow and Küpferle) at 78 per cent. Fellner,⁴⁴ in a series of 289 children, found that 24 per cent died at birth or shortly afterward. Silberman's⁴⁵ infant mortality was 28 per cent; Dirner's⁴⁶ 37.5 per cent, and Sergent's²⁹ 68 per cent. Parry⁴¹ states that 50 per cent of children of tuberculous mothers die during early months of life. In a series of cases of laryngeal tuberculosis Glas and Kraus⁴⁷ found that 60 per cent of infants died within a short time after birth. Trembley⁴⁸ asserts that the offspring of tuberculous parents are weak and display a tendency toward tuberculosis. Jacobi (quoted by Polak and Matthews⁴⁹) states that 70 per cent of infants succumb during the first year. Weinberg⁵⁰ places the proportion at 67.9 per cent; Zirkel⁵¹ at 58 per cent. Thus it is seen that the combined results of 14 observers show that there was an average infant mortality of 58.83 per cent among children born of tuberculous mothers. Miller and Woodruff⁵² examined 150 children of tuberculous parents and found 51 per cent positively tuberculous. Floyd and Bowditch⁵³ found 66 per cent. Kunreuther⁵⁴ also emphasizes the

unfavorable prognosis for children of tuberculous mothers, and records one family in which there were 6 children, of whom 3 had died of tuberculosis and all the others were infected. Bacon¹⁹ estimates that, of the 10,000 children under 5 years of age who die annually in the United States of tuberculosis, 7,500, or 75 per cent, are born of tuberculous mothers. Armand-Delille⁵⁵ studied a series of 787 children born or living in 175 families, one or more members of which were tuberculous. Of these children, 323 were placed in the country and did well; 396 were not removed from their infectious surroundings, and of these 238 developed tuberculosis. From this can be seen the postnatal danger to which the child of a tuberculous mother is exposed.

Doubtless a large proportion of the mortality of the children is the result of death or invalidism of the mother, which often leaves the child without adequate care. Many of the infants of tuberculous mothers are bottle fed even during the mother's life, and the mortality among such children is naturally high. Kingsford⁵⁶ reports the result of his study of 339 post-mortem records of children who had died of tuberculosis. Of these, 162 had died during the first two years of life, and 270 during the first five years. These records show how fatal tuberculosis is in the young.

Many authorities believe that the children of a tuberculous mother are constitutional weaklings. In this the author concurs only to a limited extent. The author has seen large healthy children born from mothers in the last stages of the disease. Some possible causes for the high infant mortality other than constitutional weakness have already been suggested. It is, however, probable that, if a large series of such infants was compared with a series from normal women, the former would be found smaller and weaker in the average, and this would probably also be the case, if a series of infants of anemic or otherwise weakened but non-tuberculous women were studied. In other words, it does not seem probable that tuberculosis exerts any specific action on the infant other than would be produced by any other weakening condition.

Influence of Pulmonary Tuberculosis on the Course of Pregnancy.—The question of sexual desire in the tuberculous has already been discussed. The fertility of the tuberculous is a subject of great importance. The tuberculous woman is quite as likely to conceive as is the normal woman. Indeed, Shauta³⁷ believes that tuberculous women are especially fertile, and states that he has found it necessary in some of his cases to induce abortion two or three times in a year. On the other hand, Pinard⁵⁷ is of the opinion that pregnancy is relatively uncommon among women affected with an active tuberculosis. Even in advanced

cases, in this author's experience, conception is relatively infrequent. The employment of methods to prevent conception, so often adopted, is probably the chief reason why pregnancy does not occur even more frequently. After conception has taken place, the tuberculosis has little influence on the course of the pregnancy per se. As the result of excessive coughing, progressive anemia, or hyperpyrexia, abortion or premature labor may occasionally occur, but this is comparatively infrequent. The tuberculous gravida is probably especially prone to develop such complications as renal disturbances and gastric disorders. Excessive vomiting and renal insufficiency may in themselves bring about abortion or miscarriage. As has been stated, in advanced cases abortion or miscarriage occasionally occurs, and this is especially likely to take place just before a lethal termination of the disease and in the event of a laryngeal involvement. Both De Lee ¹⁶ and Williams ⁵⁸ state that the disease does not predispose to premature interruption of pregnancy, unless the pulmonary lesion be of the florid or fulminating type. In such cases the cough and hemoptysis, fever, vomiting, tuberculous infection of the placenta or decidua, placental hemorrhages, etc., may precipitate a premature labor. In Glas and Kraus's ⁴⁷ series of cases, 28 per cent of patients with laryngeal tuberculosis suffered premature labor. Funk, ³⁸ in a series of 100 cases of pregnancy and tuberculosis, compiling from the total number of pregnancies, observed 7.4 per cent of miscarriages or abortions; and in a later series the same authority found that, among 200 cases, miscarriage or abortion occurred in 18 per cent of cases. Landouzy's (quoted by Pinard ⁵⁷) experiments tended to show that animals inoculated with tuberculosis before pregnancy takes place go to term, but that when inoculated during pregnancy, they may abort, the effect depending upon the virulence of the microorganisms.

Influence of Pregnancy Upon the Course of Pulmonary Tuberculosis.—Of even more importance than the life of the unborn child is the question of the influence pregnancy will have upon the course of the tuberculosis in the woman. Before undertaking the systematic study of this condition, and influenced only by the literature and a few personal observations, the author was of the opinion that too much stress had been laid upon the deleterious influence of pregnancy upon tuberculosis, and he believed further that most of the German investigators were far too pessimistic in their prognosis regarding these cases, and that their mode of treatment was far too radical. Within the last 9 years the author has examined all pregnant tuberculous women coming to the Henry Phipps Institute for treatment. The physical and bacteriologic examinations have been performed by skilled internists, and careful histories of the

pulmonary condition, weight, and general health have been kept. After delivery each case was kept under observation by a social worker, who visited the patient in her home. Following the puerperium an endeavor was made to have each patient return to the Henry Phipps Institute for further treatment. New charts showing the pulmonary condition were then made. The infants received the necessary treatment, and the mothers were instructed in special clinics as to the proper hygiene, etc. A pelvic examination was also made in each case. In this way, in the majority of cases, the condition of the patient has been under observation for at least one year. Ninety per cent of the patients at the Phipps Institute are foreigners, and are, as a general rule, an extremely ignorant class, and therefore unsatisfactory patients.

Granting that these patients are, as a rule, unfavorable subjects for treatment, notwithstanding the excellent work done by the social service department of the Phipps Institute, no observer can fail to be impressed with the unfavorable influence often exerted by pregnancy on the course of pulmonary tuberculosis. Again, however, we can only generalize, and must once more emphasize the fact that each case must be studied individually. In the author's series not a few cases of advanced tuberculosis, which were first seen in the middle or later months of pregnancy, withstood well the test of the later months of pregnancy, labor, and the puerperium, and were at least as well six or nine months after delivery as they were at the sixth or seventh month. Such cases are, however, the exception. The author recalls one case of advanced bilateral pulmonary tuberculosis that had been bedridden at the Phipps Institute for three months, and that had suffered frequent and profuse hemorrhages. These were especially frequent and copious during the ninth month. The patient was removed to the author's service at the Maternity Hospital, where everything was held in readiness for the performance of cesarean section, as it seemed almost certain that the strain of labor would induce an excessive hemoptysis. This patient was nursed carefully and when the labor started spontaneously, a modified form of twilight sleep was induced. No hemoptysis occurred; the first stage was normal, and as soon as complete dilatation had occurred, delivery was effected with forceps. This patient improved and was alive one year later, although still suffering from the pulmonary disease. This case is cited merely to show how difficult it is to foretell just what is likely to occur in a given case. The frequent hemoptysis that was present during the last months of pregnancy, often brought on by a slight attack of coughing, made it seem likely that, with the onset of labor pains, a copious hemorrhage would take place, and while the labor was made as easy as possible for the pa-

tient, no hemorrhage of any kind occurred. Furthermore, the outlook for this patient, even if she did survive the hemorrhages, was extremely unfavorable. As a matter of fact, the dreaded puerperium was passed without any exacerbation, and improvement set in almost immediately after delivery. In the series of cases here under discussion, unfortunately, only too frequently the reverse occurred. Patients who were apparently favorable subjects suddenly developed symptoms of a marked exacerbation of the disease; in some cases this occurred during the pregnancy, but in more it took place during the puerperium.

A number of authorities argue that, since no one can tell which apparently favorable cases will do well and which will do badly, the correct treatment of all cases of early pregnancy is, therefore, to empty the uterus, and thus be on the safe side. However, the reverse is also true, although, unfortunately, in a much smaller percentage of cases. Even the test of pregnancy is no certain criterion, as even the cases that do well during this period may suffer severe exacerbations during the puerperium.

Furthermore, apart from an exacerbation of the pulmonary condition, it seems but logical to assume that obstetric complications will develop more frequently in these patients than in normal individuals. In nearly all tuberculous patients, forceps, version, or some other form of operative delivery is indicated, and this in itself tends to increase the likelihood of sepsis, lacerations, and other complications, and thus to increase the maternal and infant mortality. The anemia and general weakened condition of many of the mothers also constitute a factor in increasing the proportion of dystocia and other obstetric complications. Lebirt⁵⁹ found that pregnancy had a bad influence on the course of tuberculosis in 75 per cent of cases. Deibel⁴³ found this to occur in 64 per cent of cases; von Rosthorn⁶⁰ in 70 per cent. Von Bardeleben³² found this to be true in 71 per cent, and states that 47 per cent of these patients died during pregnancy, labor, or the puerperium. In all von Bardeleben's mild cases there was more or less, sometimes only slight, aggravation of symptoms during pregnancy or the puerperium; in most of these cases the acute symptoms subsided, at least to some extent, in from 8 to 12 months. In this series 16 per cent were presumably closed lesions when the pregnancy occurred, 12 per cent were severe or acute cases, and all exhibited an aggravation of the disease, especially toward the close of pregnancy. Heiman's collected statistics (quoted by Schauta³⁷) showed that pulmonary lesions grew worse during pregnancy in 73.4 per cent. Pankow and Küpferle⁴² found that 94 per cent of their cases of active pulmonary lesions grew worse. Reiche⁶¹ observed ill effects in 77 per cent, and

Freund (quoted by Pankow and Küpfierle⁴²) in 38 per cent of cases. Of Lobenstine's⁶² 10 cases, all grew worse and only 4 survived labor for 3 months. Fellner⁴⁴ and Schauta³⁷ found that quiescent or mild chronic cases that had been well for a considerable period prior to pregnancy, suffered a relapse in 68 per cent of cases. Pradell's (quoted by Schauta³⁷) findings were even less favorable. In a series of 1035 cases he found that 95 per cent grew worse. Kunreuther⁵⁴ also emphasizes the dangers incident to this condition. Merletti⁶³ found that 50 per cent grew worse during pregnancy; von Rosthorn,⁶⁰ 70 per cent; Kamina,⁶⁴ 50 per cent. Schauta³⁷ states that in tuberculous guinea pigs pregnancy distinctly shortens the life of the animal. Schauta quotes the authorities from German sanatoria to the effect that only 25 per cent of tuberculous women were able to work 4 years after childbirth, and that all these are by no means cured cases. Albeck, of Norway (quoted by Schauta³⁷), found that of 16 cases, all of which were treated in private sanatoria and were, therefore, presumably receiving excellent treatment, 6 died within 15 months. Essen-Möller (quoted by Schauta³⁷) reports that death or aggravation occurred in 50 per cent of his series of sanatorium patients. Schauta states that in at least 75 per cent of all cases the disease was aggravated as the result of the pregnancy. Ebeler,⁶⁵ from a study of 32 cases, recommends the immediate emptying of the uterus unconditionally in every stage and in any month of pregnancy. Parry⁴¹ reports that in her series of 38 cases, all of which were of the severe type, 50 per cent died within 2 months after labor. Fellner⁴⁴ observed a general maternal mortality of 9 per cent. Osler quotes Dubois to the effect that "If a woman threatened with tuberculosis marries, she may bear the first accouchement well, the second with difficulty, and the third never." Malsbary¹⁴ found the highest mortality among primiparae. Bacon¹⁹ estimates that 33 per cent of tuberculous women who become pregnant die in less than one year following labor. Hoffman⁶⁶ found that the greatest mortality among tuberculous women was between the ages of 15 and 45 years (195.5 per 100,000 population), whereas in men the highest mortality was between 45 and 64 years (254 per 100,000), indicating that many tuberculous women die as the result of pregnancy and childbirth. Schlimpert⁶⁷ asserts that the greatest number of deaths from tuberculosis during pregnancy occur in childbed.

In reviewing the foregoing statistics, a number of facts must be taken into consideration. A certain number of cases of pulmonary tuberculosis will exhibit exacerbations, even when not pregnant, and this proportion must be deducted from the figures here given when considering the influence of pregnancy upon the course of the disease. On the other hand,

statistics compiled from maternity hospitals, from which patients are discharged in one or two weeks after labor, no further trace being kept of them, are misleading in that no note can thus be made of the exacerbations occurring in the late puerperium or during lactation. In this class belong the majority of statistics compiled from English and American hospitals. Only when the cases are carefully followed for at least six months (some authorities assert for two years or more) can accurate figures be obtained. Owing largely to their registration laws, the opportunities for the German to gather figures were exceptional, and their statistics are therefore valuable. In reviewing the literature on this subject, it must also be remembered that in Catholic countries the general feeling against the induction of abortion must be taken into consideration, and doubtless influences the view of many operators.

Laryngeal Tuberculosis.—This variety of tuberculosis has its onset with very great frequency during pregnancy, and always influences the prognosis unfavorably. In the author's experience this complication occurred most commonly in cases in which the pulmonary lesions were active. However, Bandelier and Röpke²⁸ state that laryngeal tuberculosis frequently appears when the pulmonary condition is showing few symptoms. During pregnancy laryngeal tuberculosis exhibits a marked tendency to extend, and this despite any form of treatment. Von Sokolowski⁶⁸ states that he has observed cases of laryngeal tuberculosis that have endured pregnancy without developing any serious complication. In the author's experience this, however, is exceptional. Milligan⁶⁹ states that laryngeal involvement occurs in from 33 to 40 per cent of all cases of pulmonary tuberculosis.

The clinical manifestations are difficulty in talking, due to weakness of the vocal cords, the voice becoming low and hoarse; the patient complains of a feeling of fullness or tickling in the larynx, and there is a frequent desire to clear the throat; usually there is more or less difficulty in swallowing. Any symptom suggestive of this complication demands immediate investigation and a laryngoscopic examination to determine with certainty the condition present.

Milligan states that hyperemia of one vocal cord often precedes for some time a more definite involvement. As has been stated, when laryngeal involvement occurs, the prognosis becomes extremely grave. Whether or not this complication shall be regarded as an absolute indication for the interruption of pregnancy, will be discussed under the head of Treatment. Local treatment of laryngeal tuberculosis is often of little avail. Some authorities recommend an application of 25 per cent argyrol or of some bland lotion; gargles, the swallowing or holding in the mouth

of bits of ice, and the application of an ice bag externally may give temporary relief. Vagni⁷⁰ recommends electrocauterization. In extreme cases trachelotomy may be demanded as a life saving measure. Glas and Kraus⁴⁷ state that where there is ulceration, with relative stenosis, trachelotomy may materially improve the laryngeal condition. Healed laryngeal lesions are prone to undergo exacerbations, if pregnancy takes place.

Practically all authorities recognize the gravity of laryngeal involvement in tuberculosis. Fellner,⁴⁴ in his series of 289 cases, had a maternal mortality of 44 per cent. Of 231 cases of laryngeal tuberculosis collected from the literature by Lobenstine,⁶² 200 died during pregnancy, in labor, or soon after—a mortality of 86 per cent. In this series of cases spontaneous abortion and premature labor were not infrequent. Raspini⁷¹ emphasizes the ill effects of laryngeal involvement. In the combined mortality statistics from all series of deaths from tuberculosis and pregnancy, cases of laryngeal involvement constitute a very definite percentage. The death rate among the infants of these patients is about 60 per cent. Imhofer⁷² reports a mortality of from 86 to 90 per cent in those cases in which laryngeal involvement occurs; Küttner, 90 per cent; Stöckel, Lasogna,⁷⁴ Pankow and Küpferle,⁴² Lubliner,⁷⁵ von Sokolowski,⁶⁸ and others give practically similar figures.

Influence of Lactation on the Course of Pulmonary Tuberculosis.

—It is generally conceded that lactation exerts an unfavorable influence on the course of pulmonary tuberculosis. In practically all our cases the child has been taken from the mother and fed from the bottle, or, in a few instances, with a wet nurse. Among the extremely ignorant, bottle feeding is undoubtedly attended by a high infant mortality. In a few instances in our series breast feeding has seemed the lesser of two evils. In those cases the mothers were of a class that would make bottle feeding extremely dangerous, and in all these women the pulmonary lesions were mild and there was little or no expectoration. In two additional cases of which we have record the mothers began nursing their children after discharge from the Maternity Hospital, despite instructions and warnings. In both these cases the infants succumbed in less than one year, and both apparently from tuberculosis, although this is not certain, since post-mortems were not obtainable. Clinical signs of the disease were, however, present in both instances.

TUBERCLE BACILLI IN THE MATERNAL MILK.—The question as to whether the mother's milk is likely to contain tubercle bacilli is of at least theoretic interest. In 9 examinations performed by the author by means of animal inoculation, no tubercle bacilli were demonstrated. The

milk used for these experiments was obtained in each case less than one week after labor, except in one instance, in which a mother with a closed lesion was nursing a three months old infant. Two of the remaining cases were in the last stages of the disease, whereas the remainder were moderately advanced. Tubercle bacilli have, however, been demonstrated in the mother's milk by Escherich, Rabinovitsch, and Kempner (all quoted by Malsbary¹⁴). Auché⁷⁶ has published an interesting article on this subject. Bandelier and Röpke²⁸ state that the danger of transference of tubercle bacilli to the infant through the mother's milk is a very real one. These authors believe that the milk of a tuberculous woman contains a toxin that lowers the resisting powers of the child. Cornet¹⁸ was able in rare instances to demonstrate the presence of tubercle bacilli in the milk of tuberculous women. Recent investigations show that tubercle bacilli are found in the milk more frequently than was formerly believed, especially in the miliary variety of the disease, or in those patients suffering from an acute exacerbation. It is, therefore, undesirable to feed the infants with mother's milk, even if this be obtained by means of a breast pump. The chief danger of breast feeding to the child is, however, due to accidental contamination, such as occurs from infected fingers carrying tubercle bacilli to the child's mouth, either directly or from infection of the nipples. Kissing and handling of the infant by the mother are a fertile source of infection, and these accidental contaminations are probably much more likely to occur than is a direct transference of the disease by tubercle-bacilli-bearing milk, and probably constitute the chief danger of nursing.

Tuberculin in Pregnancy.—Kalabin (quoted by Schauta³⁷) recommended tuberculin in the treatment of these cases. More recent investigators have not, however, confirmed the value of this remedy. Martin (quoted by Schauta) considers that a positive ophthalmic reaction in the tuberculous pregnant woman is a favorable sign, as indicating the presence of a sufficient number of antibodies to protect the patient against extensive invasion. Veit, Kraus (quoted by Bandelier and Röpke²⁸), and Kaminer (quoted by Schauta³⁷) believe, as does also the author, that the test is of no value as a diagnostic sign. The cutaneous reaction is also valueless as a prognostic aid. Even for diagnostic purposes the cutaneous test during pregnancy becomes less certain in its results.

Tuberculin During Lactation.—Palmer⁷⁷ states that he has for some time employed tuberculin as a diagnostic agent in certain cases. He has used it guardedly in this way from time to time, and has witnessed many pronounced reactions, without the slightest disturbances in the infant, although he is convinced that in at least three instances the

breast fed infants were clinically tuberculous at the time the mothers were given the test. This observer reports one case in which the administration of tuberculin to the mother was followed by a definite exacerbation in the infant, from which it died ten days later. He concludes that in this case it hardly seems possible that sufficient tuberculin could have reached the child to cause the slightest disturbance, and he is inclined to attribute the exacerbation in the infant to coincidence. Nevertheless, he directs that extreme caution should be employed in giving tuberculin to nursing mothers. Schlosmann⁷⁸ has employed the test in 49 nursing mothers; in 18, or 36.8 per cent of these there was more or less reaction, but in none was the child affected in any way. At best, the use of tuberculin is not without danger.

Prophylactic Measures.—Many authorities believe that tuberculous individuals should not marry. As a general rule, marriage is more harmful for tuberculous women than for tuberculous men. Indeed, many men appear to improve after marriage. The danger to their wives and possible progeny must, however, be taken into consideration. We believe that, as a general principle, it is correct to advise the tuberculous woman against marriage, but a hard and fast rule to this effect cannot be laid down. Certainly marriage should be advised against in the presence of any active lesion, no matter how limited in extent. On the other hand, it seems too radical an attitude to forbid the woman with a small, non-active closed lesion, which has been in abeyance for two or three years, to marry. Recent investigations seem to show that, at least among the intelligent, marital infection of tuberculosis is less frequent than was formerly believed.

Should a husband or a wife become infected, sanatorium treatment is advisable, at least for a time, not only for the good of the patient, but as a means of protecting the family and in order that the patient may learn prophylaxis, to guard others. Some authorities recommend sterilization of the tuberculous wife, if it becomes necessary to empty the uterus on account of the disease. This the author believes to be unjustifiable, except in exceptional circumstances. Knopf⁷⁹ is of the opinion that every man who has an active pulmonary tuberculosis should undergo a vasectomy, and that a bilateral salpingectomy should be performed upon every affected woman.

LAW REGARDING THE MARRIAGE OF TUBERCULOUS PERSONS.—That the healthy individual who marries a tuberculous person runs some risk of contracting the disease is well known, the risk varying in degree with the type of the lesion and the intelligence of the contracting parties. The Supreme Court of New York (Special Term, New York County, Sobol

vs. Sobol, N. Y. Supp. 248; Reference from *J. Am. Med. A.* 1915,⁶⁴ 1024) holds that fraudulent concealment of tuberculosis by a person entering into the marriage relation is ground for annulment of the marriage. In this case it was established that the defendant had been treated for tuberculosis prior to the time of his marriage, and that he knew that he was suffering from the disease. Before marriage he explained to the plaintiff that his symptoms were manifestations of a cold. Furthermore, it appeared that, a few days subsequent to the marriage, the defendant's condition was such as to require the services of a physician, who diagnosed the case as tuberculosis. The court based its opinion on the concealment of the disease, the possible effect on one of the contracting parties, and upon their posterity. The court deemed it proper, in view of the wide spread prevalence of tuberculosis and the disastrous consequences to those who suffer from it, to take judicial notice of its characteristics, for the purpose of this discussion. There can be no doubt that the disease is of an infectious nature, and that close association with a person thus afflicted, unless attended with great care, exposes those coming in contact with such persons to the danger of infection. Tissier⁸⁰ states that the induction of abortion is against the law in France, and that it can be performed only by "the intelligent tolerance of the civic authorities."

The chief danger to the tuberculous married woman is pregnancy, and her safest plan, regardless of the nature of her lesion, is to avoid conception. Although this may be a great hardship to her and her husband, there can be no doubt regarding the truth of this assertion. We have previously endeavored to emphasize the necessity for individualizing in the case of these patients. Occasionally a case may occur in which the lesion is limited in extent and has been inactive for not less than two years. Under such circumstances, if the patient is intelligent and able to avail herself of proper treatment and supervision, and if she is especially desirous of having a child, conception is justifiable. These cases are, however, exceptional, and even under the most favorable circumstances such a patient materially increases the risk of bringing on an exacerbation of her disease. If one or two children are living at the time that the woman becomes infected or seeks advice, conception is best advised against in all cases. It is impossible to escape the fact that any form of pulmonary tuberculosis, no matter how limited in extent, is especially prone to become aggravated during the pregnancy and the puerperium. Some cases may do well, and, as the result of a limited experience, the physician may easily be led to underestimate the dangers of pregnancy. Unfortunately, despite the most painstaking study, we are as yet unable to determine with certainty which case will bear pregnancy and the puerperium

well, and which will fare badly. No positive prognosis can, therefore, be given in the case of an individual patient. At times, even those cases that appear most favorable will result disastrously, and occasionally, though unfortunately only in a small proportion of instances, the reverse will be the case. The safest plan for the woman, therefore, is to avoid conception. In those exceptional cases in which conception has been countenanced, strict hygienic measures must be enforced, and the woman kept under close observation and examined at frequent intervals by an experienced internist.

Dice⁸¹ divides the non-active cases into two classes—first, the early cases, in which the patients are apparently cured, where the tuberculous process is arrested, and secondly, those in which the disease is fairly well advanced, but has been inactive for two or more years. Even in the most favorable cases, Dice advises against pregnancy, unless there has been a period of quiescence of not less than two years, and even in such cases he believes the dangers of pregnancy are by no means small. In determining the extent of the pulmonary lesions in non-active cases, the X-ray has been found a valuable aid.

Treatment of Pregnancy and Tuberculosis.—As a matter of fact, the physician is frequently not consulted regarding the advisability of either marriage or conception, and often sees the case for the first time after pregnancy has taken place. This is especially true of the ignorant classes, and even the intelligent are as yet not sufficiently educated upon this point. If pregnancy has taken place, the most important point to be decided is, shall the uterus be emptied, and if so, what are the indications for performing abortion.

A GENERAL HYGIENIC AND DIETARY TREATMENT.—All cases of pregnancy occurring in tuberculous women should be subject to a rigid hygienic and dietary treatment. This should be instituted as soon as tuberculosis is diagnosed, but it is especially important if pregnancy occurs. The pregnant tuberculous woman needs every possible aid in combating her infection. She should, therefore, be placed under the care of a physician who understands this special form of treatment. If it becomes necessary to interrupt the pregnancy, there should be as little break in the hygienic régime as possible. If the weather is at all suitable, the patient's convalescence will be more satisfactorily accomplished by placing her out of doors. This is particularly true of those cases that have been accustomed to an out of door life prior to the operation. Even in the most favorable postoperative cases, the hygienic régime should be continued for at least three, and preferably for six or more months, following the termination of pregnancy.

These cases are, as a rule, best treated in a well conducted sanatorium, and if the operation cannot be performed there, the patient should be removed to such an institution as soon as possible after the operation.

DIAGNOSIS.—Presuming that the diagnosis of tuberculosis has been established beyond doubt, the question of the attitude the physician shall assume is of the greatest importance. In cases of early pregnancy the diagnosis of the latter condition is somewhat difficult. Too much attention must not be paid to amenorrhea as a diagnostic sign, as this is not an infrequent symptom in tuberculosis. In our series of 214 cases of tuberculosis in which the menstrual changes were especially studied, total amenorrhea was present in 5 per cent of cases, and scanty or irregular flow was observed in an additional 53 per cent of patients. Schauta³⁷ states that the opinion of the medical world regarding the treatment of pregnancy in the tuberculous may be divided into three groups: the first, the French school, which admits the unfavorable effect of pregnancy on the course of pulmonary tuberculosis, but declines to induce abortion, placing its hopes for success upon diet, hygiene, etc.; the second group, which consists of those who individualize, and who induce abortion if the tuberculosis is advancing, but if it is not, employ general treatment and supervision; and the third, which considers tuberculosis an unconditional indication for abortion.

The author is not in accord with any of these groups, but believes that the attitude toward any given case must depend upon the conditions surrounding it. In considering the subject, many factors must be taken into consideration, among the most important of which are the advancement of the pregnancy and the character of the pulmonary lesion, the social status of the patient, her intelligence, whether she is able and willing to observe proper hygienic and dietary precautions, her financial condition, her mental attitude, the question of whether she already has one or more children. These considerations are all factors of the utmost importance, and should be weighed carefully before determining upon the treatment to be instituted. No hard and fast rules that will be applicable to all cases can, therefore, be laid down.

In the early months of pregnancy, with a rapidly advancing pulmonary lesion, there can be no question that the induction of abortion should be performed without loss of time, and this is also true if laryngeal involvement occurs. On the other hand, given a similar case in the late months of pregnancy, little can be gained by the induction of premature labor. The most dangerous period—the puerperium—will occur in any event, and under such circumstances it is usually better to direct all one's efforts

toward establishing the well being of the child, as in any event the mother is probably doomed.

Speaking on the broadest general lines, the cases of pregnancy in the tuberculous may be divided into two groups, according to the advancement of the gestation, the first group consisting of those cases seen prior to the fifth month, and the second, those encountered from the fifth month on.

Indications for the Induction of An Abortion in the Tuberculous Prior to the Fifth Month.—The writer believes that in the presence of an extensive lesion, even in the quiescent stage, or even of a small active lesion, the uterus should be emptied at once. This also applies to those cases in which laryngeal involvement of any degree is present. The development of secondary tuberculous lesions in parts of the body other than the lungs is also an indication for this procedure in most cases. Excessive vomiting, renal insufficiency, and other complications of pregnancy may, as in the normal woman, constitute indications for emptying the uterus. It must be remembered that the tuberculous woman has less resisting power than the uninfected one. Our object is to maintain her powers of resistance at their highest point—in other words, to improve her general health. This is of the utmost importance. Gastric disturbances or other complications that might be borne by the normal woman may be sufficient to lower the tuberculous patient's resisting powers to such an extent that an exacerbation may occur. For this reason, intervention should be employed considerably earlier in the tuberculous woman and for a milder degree of complications than in the normal woman. Loss of weight is not in itself an indication for the induction of abortion. It is, however, a danger signal of great practical value. Veit⁸² rightly lays special stress upon the prognostic value of a loss or a gain in weight. Women who lose weight in the latter months of pregnancy often succumb during the puerperium. As a general rule, the earlier the intervention, the better is the prognosis.

A much more difficult point to determine is the attitude of the physician toward the patient with a quiescent lesion of moderate or small extent. Here the patient must be studied individually, and the points previously referred to considered. It must be remembered that in every such case the woman runs an added risk by allowing the pregnancy to continue. It is conceded that intervention in the early months of pregnancy is productive of at least moderately good results, but that intervention in the latter months of gestation is of little value. One of the chief dangers, therefore, in these cases is that the patient may do well until about the sixth or the eighth month, when it is too late to do any good

by emptying the uterus. As has previously been stated, it is impossible to determine with certainty which case will, and which will not, do well. On the other hand, it is by no means justifiable to advise the induction of abortion in every case. As a general rule, the longer the lesion has been inactive, the better is the prognosis. Lesions of limited extent and those that have never shown very marked activity are also more favorable. A factor of the utmost importance is whether or not the patient is in a position to obtain proper hygienic and dietary treatment. If, during the course of observation, and prior to the fifth month, evidence of laryngeal involvement or an exacerbation of any sort arises, the safest plan is to advise immediate intervention.

Results of Abortion in the Tuberculous Prior to the Fifth Month.

—Owing to the many factors that enter into their compilation, statistics are sometimes misleading. The types of cases from which they are drawn, and the closeness with which they are afterward followed, are points that tend to increase or to nullify their value regarding this condition. What may be considered justifiable grounds for emptying the uterus by one authority may not be so regarded by another. The physician who routinely recommends intervention in all cases will naturally be able to show better figures regarding maternity mortality than will the one who waits for the onset of an exacerbation before emptying the uterus. Pradella (quoted by Schauta ³⁷) attempted to classify his cases of pregnancy, regardless of their degree of advancement, according to the extent of their pulmonary lesion. He found that, in the first stage of tuberculosis, emptying of the uterus had a beneficial effect in 89 per cent of cases, in the second stage in 83 per cent, and in the third stage in 25 per cent. In cases of tuberculosis in the first stage and less than one month pregnant, Pradella found that the induction of abortion was successful in 91 per cent of all cases. Kaminer (quoted by Schauta ³⁷) takes a more pessimistic view. He states that he has never seen a cure, but believes abortion to be of value in the early months of pregnancy. In moderately advanced or far advanced cases, however, he expects but little success, but believes that early abortion tends to limit the extent of the disease.

The interruption of pregnancy, even in early cases, is not always followed by improvement. Veit,⁸² Krönig,⁸³ and von Rosthorn⁶⁰ believe in individualizing each patient, and hold that the pregnancy should be interrupted in the early months in the event of untoward symptoms arising. Veit⁸² very properly declares that successive abortions are quite as injurious as one or two pregnancies, especially if the latter have been properly treated. This author has collected 347 cases, in which abortion

was performed in patients with active lesions. Of these, 56.7 per cent were benefited, and the remainder were unimproved. Veit quotes von Bardeleben to the effect that only 50 per cent of the latter's active cases were improved. He points to the fact that in active cases abortion may be followed by the development of miliary tuberculosis. Trembley⁸⁴ reported 29 cases in which abortion was performed, with one recrudescence. Edgar⁸⁵ believes that it is best to assume the attitude of the alarmist in these cases. Knopf⁷⁹ states that the more of these cases he sees, the more inclined he is to favor radical treatment. Werner⁸⁶ reported 60 cases operated upon in Wertheim's clinic. Of these, 1 died from hemorrhage, 1 died of tuberculosis 4 months after leaving the hospital, and 4 were but little benefited. In none of these cases had the pregnancy advanced more than five months. All had active pulmonary lesions, laryngeal involvement, were in poor physical condition, or suffered from some other complication. Of 25 patients of this series, all of whom had been operated upon not less than one year before, 1 died of tuberculosis, 20 were feeling well, and in 4 the symptoms of the disease were either unimproved or had grown worse.

Bossi⁸⁷ urges rapid mechanical dilatation, followed by curettage, and states that 40 cases terminated by this method before the sixth month gave good results. Scherschewer⁸⁸ reports favorable results obtained in 10 cases operated upon by Bumm, and in 1 from the Marburg Klinik. Hysterectomy was performed in this series. Holst,⁸⁹ as the result of his experience, recommends abortion in all cases, if the lesions are active. Schauta³⁷ takes a radical stand, and states: "We are of the opinion that in every case where tuberculosis is definitely diagnosed, the indication is to bring on abortion. Inasmuch as in at least 75 per cent of all cases the disease advances during pregnancy or in the puerperium, and as the time for advancement is uncertain, one may proceed to treat it too late. It is preferable to sacrifice the life of the child, which is in any case of doubtful value in the conditions present."

Zirkel,⁹⁰ on the basis of Hofmeier's work, recommends the induction of abortion if there is a noticeable loss of weight or an aggravation of the symptoms, and Sergent⁹¹ recommends that it be induced only in exceptional cases. Von Franque⁹² believes that abortion should be induced only when it can reasonably be expected to improve the patient's condition. Stutz⁴⁰ reports 32 cases, and recommends immediate emptying of the uterus in every stage of tuberculosis and in any month of pregnancy. In 75 per cent of the cases in the first and second stages of tuberculosis there was a marked improvement in the objective symptoms after the termination of pregnancy. In patients in the third stage the prognosis is

always bad. Von Bardeleben ³² states that there is a mortality of 2.54 per cent among incipient cases, in whom the uterus is emptied prior to the fourth month of pregnancy.

Among ordinary cases from the fourth to seventh month similarly treated the mortality is from 20 to 25 per cent, and in advanced cases the death rate reaches 50 to 80 per cent. Pankow and K  pferle ⁴² state that the results in the Freiberg Frauen Klinik are relatively good, if abortion is performed early, but that a mortality of 40 per cent follows the operation when it is performed in the second half of pregnancy, and upon patients suffering from active lesions. Permin ⁹³ urges the early interruption of pregnancy when progressive lesions are present. Cred   and Holder ⁹⁴ believe that the progress of the pulmonary condition can be divided into two stages, the first stage being marked by an infiltration of the apices and the parenchyma of the lungs, and by catarrh of the apices; the second, by cavity formation, the formation of infarcts, hemoptysis, and infiltration, sometimes of the entire lobes. In the first stage, if the woman is well nourished, there is no indication for the induction of abortion. The patient should be kept under observation and examined at intervals by an internist; she should be given sanatorium treatment and especial care during labor and in the puerperium, and she should not be allowed to nurse her child. If the patient in the first stage is poorly nourished, she may become worse during pregnancy; labor is likely to be difficult, and in the puerperium exacerbations are of frequent occurrence. In these latter cases, if the pregnancy is of only a few weeks' duration, abortion should be induced; if it is of more than a few months' duration, it should be allowed to continue. The patient should be under constant supervision, breast feeding, and future conception prevented. In the second stage of the disease pregnancy is particularly dangerous. In spite of this, Cred   and Horder believe that the treatment should be the same as that for a poorly nourished woman in the first stage of the disease. These cases should be individualized. In borderline cases abortion must often be performed.

Sellheim ⁹⁵ reports the result of operation upon 10 patients, none of whom were pregnant more than 5 months. The results in all cases were good. Stutz ⁴⁰ reports 15 cases, 14 of which were operated upon through the vagina with good results. Peterson ⁹⁶ is of the opinion that pregnancy exerts a harmful influence on the course of tuberculosis, less when the disease is of the fibroid type, and is especially dangerous if a pleurisy or pneumonia should develop. He recommends individualizing all cases and advises inducing a premature delivery in some cases. McPherson ⁹⁷ believes that, in every case of incipient tuberculosis accompanying preg-

nancy, the pregnancy should be terminated. Jellett⁹⁸ believes that pulmonary tuberculosis is not influenced unfavorably by pregnancy. Rabnow and Reicher,⁹⁹ Kohne,¹⁰⁰ and Cohn¹⁰¹ are of the same opinion. Rabnow and Reicher report a series of 10 cases occurring in working women, all of whom had active lesions. Of these pregnancies 7 are reported to have had no injurious effects. Cohn reports that of 58 cases, 53 were apparently no worse for their pregnancies, and Kohne found the same to be true in 10 out of 22 cases.

It is worthy of note that these writers do not report having followed their cases for very prolonged periods subsequent to childbirth. Van Tussenbroek,¹⁰² from a study of the mortality statistics from Amsterdam and other Dutch cities, arrives at the conclusion that the mortality from tuberculosis during the first 6 months of pregnancy was increased; during the later months it was diminished in such degree that the two were about even. She found that the mortality from tuberculosis during the year following pregnancy was about equal to the general mortality among tuberculous women who had not been pregnant. The general opinion that the death rate is increased by pregnancy is, therefore, not borne out by this investigator's studies.

These results are not in accord with the author's experience, or in fact with those of most observers. Permin⁹³ urges the necessity for terminating pregnancy when the disease is advancing. Williams⁵⁸ asserts that the harmful influence exerted by pregnancy upon the course of tuberculosis is generally conceded. He believes that abortion should be performed on primiparae when the disease becomes manifest in the early months of pregnancy, but admits that premature labor is of little value. Davis³⁰ treats his patients individually, and in the early months of pregnancy he empties the uterus on the first symptoms of an exacerbation in previously mild or quiescent cases. When a patient with an active lesion, who is just holding her own, becomes pregnant, Davis believes that, in the majority of cases, abortion should be induced. The combined statistics of twenty-one observers, comprising nearly 1,000 cases, show that 77 per cent of women were benefited by the induction of abortion. The percentages vary from 20 to 97.

The diversity of opinion regarding the treatment of this condition is evidence in itself that no ideal plan has as yet been evolved. It will be noticed, however, that the general trend of opinion is toward interruption of pregnancy in the early months of gestation, and toward non-operative treatment in the second half. The author believes that the wise obstetrician will familiarize himself with the results obtained by others, and carefully consider the source and the methods employed in

compiling the statistics; that he will then individualize his cases, and empty the uterus only when it is necessary, and will not allow his natural repugnance to the performance of this operation to influence him to the detriment of his patient. The average obstetric surgeon's dislike to performing abortions is not only natural, but laudable, and may in some instances be guided by his religious belief. He may, however, comfort himself and his patient's family by following the advice of Pinard,⁵⁷ who emphasizes the fact that abortion is induced only to save the mother's life, for, as the mother will probably die without operation, abortion must, therefore, not be viewed as murder, since the child will perish if the mother dies. Unfortunately for this argument, in a certain proportion of cases the mothers live at least until the puerperium is reached. Furthermore, even apparently unfavorable cases may do well without intervention.

CONSULTATION AND PRECAUTIONS TO BE ADOPTED PRIOR TO EMPTYING THE UTERUS.—Before deciding to empty the uterus, a consultation should always be held. If any doubt exists as to the certainty of the diagnosis of tuberculosis, an experienced internist should be called in. The services of a competent bacteriologist will prove an additional safeguard. Freund¹⁰³ very properly believes that, in general, the internist's duties should consist in giving information to the gynecologist in regard to the pulmonary condition, but that he should not be the one to decide whether or not abortion should be performed, since the obstetrician or the gynecologist often has greater experience in this particular. The entire procedure should be conducted as openly as possible; the family of the patient, and in most cases, the patient herself, should be informed of what is about to be done. No loophole for subsequent criticism should be left. The prognosis should in all cases be guarded, for benefit may not accrue from emptying the uterus, and the family should be so informed, and the true state of affairs explained to them as nearly as possible. With the patient herself a more optimistic view is justifiable.

Choice of Operation.—If having decided upon intervention and having obtained consultation, and secured the consent of the family and of the patient, the next question to be determined is the method of operation. No matter what method is selected, the operation should be performed by an experienced obstetric surgeon in a well equipped hospital.

STERILIZATION OF THE TUBERCULOUS.—Many methods of operation have been advised, some operators advocating the vaginal and others the abdominal route. Some advocates of the former method and many of the latter recommend sterilization of the patient by one method or another, for the purpose of preventing future conception. Among these

are Sellheim,⁹⁵ Stutz,⁴⁰ Werner,⁸⁶ von Franque,⁹² Schottelius,¹⁰⁴ Höhne,¹⁰⁵ Ebeler,⁶⁵ von Bardeleben,³² Martin,¹⁰⁶ Pankow and Kupferle,⁴² Schauta,³⁷ Kunreuther,⁵⁴ and others. Many operators also advise excising the placental site. The author believes that routine sterilization is entirely unjustifiable, regardless of the method employed. Certainly, in the average case in which the uterus is emptied there is some hope of effecting a cure of the tuberculosis. Some operators advise the performance of a type of operation that permits, if it should be desired at a subsequent time, of the reconstruction of the genital tract, so that conception may take place. Gauss¹⁰⁷ recommends effecting sterilization by means of the X-rays. It is claimed for the X-rays that they may be applied so as to produce either temporary or permanent sterilization. Pincus¹⁰⁸ employs atmocautery for the purpose of producing sterilization. Without being influenced by a desire to evade the responsibility of the operation of sterilization, it is better to place the responsibility of pregnancy upon the woman or upon her husband by advising them to avoid subsequent pregnancies, unless the pulmonary condition improves sufficiently to permit pregnancy to be carried out with a reasonable degree of safety. The operation of sterilization necessitates opening the peritoneal cavity and prolongs the operative procedure, two factors that cannot fail materially to increase the mortality incident to the operation. Dice⁸¹ advises that the surgeon safeguard himself from subsequent criticism or legal responsibility by obtaining a written agreement from the parties concerned before sterilizing the patient.

ANESTHESIA.—The question of inducing anesthesia is of vital importance in these cases, and will be dealt with in detail in a subsequent chapter. It will suffice here to state that in every case of very early pregnancy—under 4 or 6 weeks—curettage can often be performed without the aid of an anesthetic, a hypodermic injection of a 1/4 grain of morphin and 1/150 grain of scopolamin often being sufficient for the purpose. If the patient is a highly nervous woman, a few whiffs of nitrous oxide gas may be necessary. When performing this operation upon a conscious patient, the author has sometimes employed a weak solution of cocain or eucain applied to the cervical canal by means of cotton soaked in the solution. In inactive cases Anderes¹⁰⁹ reports that at the Zurich clinic chloroform and oxygen in combination is employed, and in the presence of active lesions, spinal anesthesia is used with excellent results. As a general anesthetic nitrous oxide gas should be the choice. The anesthetic must, however, be carefully administered.

TECHNIC FOR EMPTYING OF THE UTERUS PRIOR TO THE END OF THE SECOND MONTH OF PREGNANCY.—Prior to the eighth or ninth

week, curettage is the operation of choice, the uterus being emptied as nearly as possible at one sitting. If the cervix is unusually rigid, a preliminary cervical pack of gauze may be employed for from twelve to twenty-four hours prior to the operation. Since the operation should be as complete as possible, thorough dilatation of the cervix is to be obtained. Thorough dilatation increases the speed with which the operation may be performed, and also conserves the blood. The latter is of especial importance, and as no bleeding occurs until the dilatation is completed, this procedure should be thoroughly performed. After the uterus is empty, or as nearly empty as seems advisable, a gauze pack should be inserted. Shortly before the completion of the operation ergotin or pituitrin may be administered. The pack may be removed in about five minutes, and, if little bleeding occurs, it need not be reintroduced. In the majority of cases, however, more or less oozing will continue, and as it is highly important that the blood be conserved, the pack should, under such circumstances, be reintroduced, special care being taken to pack the fundus of the uterus firmly. Carelessness in this respect may result in a firm stopper of gauze in the lower uterine segment, above which more or less blood may accumulate. The pack should be removed within twenty-four hours. Any remnants of membrane, etc., that may have escaped the curet usually come away with the gauze at this time. It is generally advisable to administer ergot or ergotin at six-hour intervals for the first twenty-four or thirty-six hours subsequent to the operation. The Fowler position is beneficial, materially aiding by gravity in the drainage of the uterus. If it is not employed, or if there is an extreme retrodisplacement of the uterus, the patient should be encouraged to turn frequently upon her side or her face, thereby aiding uterine drainage.

Thorough emptying of the uterus at the time of operation is far preferable to simple breaking up of the gestation sac, and means a more rapid convalescence and, in the long run, the conservation of blood.

CONVALESCENCE.—At the end of twenty-four hours, or immediately, if the weather conditions permit, the patient should be removed out of doors and the hygienic and dietary treatment suitable for pulmonary tuberculosis continued. If the operation has been complete, the patient can usually be out of bed by the fifth day; if the gestation has been an early one, she may leave her bed the third day, provided no complications have arisen and the pulmonary condition permits.

TECHNIC OF OPERATION AFTER PREGNANCY HAS ADVANCED BEYOND THE SECOND MONTH.—Vaginal hysterotomy is as a rule the most

satisfactory operation for emptying the uterus. It is performed as follows: The field is prepared, as for any vaginal operation. The cervix is pulled down, the bladder stripped off by blunt dissection, using the fingers wound with dry gauze until the peritoneum comes into view. The peritoneal cavity is not opened. At this stage it is advisable to administer a hypodermic of ergotin. The cervix is then split in the median line. The membranes then bulge into the wound and are incised. The amniotic liquor is evacuated and the fetus is delivered. A large gallstone forceps applied to the fetal head is an excellent instrument with which to accomplish this step of the operation. A little care at this point of the operation will save much time. If the fetus is decapitated or an attempt is made to remove it piecemeal, much time is lost. After the delivery of the fetus, the placenta and membranes can be easily removed manually. The cervix is sewn up with interrupted No. 1 catgut sutures, and the vaginal mucosa sutured in its original position. The uterus is then replaced manually in its normal position and the patient catheterized. To guard against unnecessary loss of blood, traction should be made upon the cervix continuously, the operator depending as much as possible upon blunt dissection. It is important that the operation be confined as much as possible to the median line, as thus a less vascular field is encountered. Few ligatures will be required, although hemostasis should be thoroughly carried out. In one instance, in the case of a firm unyielding vaginal outlet with a high cervix, which could not be brought down, in an elderly primipara, the writer employed episiotomy, choosing this operation in preference to working through a small, unyielding opening that would have prolonged materially the vaginal hysterotomy.

The after care of these patients is the same as that advised for those upon whom curettage has been performed. The patients are out of bed on the fifth day. The author has had uniform success with this operation.

The operation requires from fifteen to twenty minutes, and it is surprising how little bleeding occurs. A preliminary dose of morphin, sometimes supplemented with scopolamin, is advisable. The patient should be placed in the lithotomy position, and the vagina and external genitalia prepared for operation prior to the administration of the anesthetic. (See Chapter on Anesthesia in Pulmonary Tuberculosis.)

This operation has these advantages, that there is little bleeding, that the uterus can be completely emptied at the time of operation, that there is no subsequent oozing from the uterus, and convalescence is

rapid. The further the pregnancy is advanced, the more decided is the indication for vaginal hysterotomy.

It must, however, be remembered that emptying the uterus in this class of cases is only indicated when the pulmonary lesions are active or advanced. Both of these are conditions which make the administration of a general anesthetic especially hazardous. In some cases, therefore, dilatation of the cervix, and simple breaking up of membranes and removal with placental forceps or a large dull curette of as much as possible of the products of conception, is the safer plan. This operation has the further advantage that it can be performed under a local anesthetic, or in many cases without anesthesia of any kind, although the preliminary administration of morphin and scopolamin facilitates the procedure. The disadvantages of this operation are that it is almost impossible to entirely empty the uterus, and in many cases nothing more than breaking up of the membranes can be accomplished. The operation is, therefore, followed by considerable free oozing which continues for two or three days, and in the end results in the loss of considerably more blood than does the vaginal hysterotomy. The uterus usually has to be packed with gauze and often it is necessary to renew this packing. This causes discomfort to the patient and adds to the danger of infection. Furthermore, the convalescence is prolonged.

Conservation of the patient's strength is of special importance; the prolonged convalescence, with the loss of blood incident to this operation, and the danger of a general anesthetic necessary with the vaginal hysterotomy, are the factors which must be weighed against each other in the choice of a method of emptying the uterus. In the hands of a skilled surgeon vaginal hysterotomy is in the author's opinion usually the lesser of the two evils, although cases will be encountered in which the mere breaking up of the membranes is clearly indicated.

As in all cases of abortion, retrodisplacement is to be guarded against. The same methods applicable to the non-tuberculous patient are satisfactory in these cases.

The Treatment of Pregnancy Advanced Beyond the Fifth Month in the Tuberculous.—As a general principle, it may be stated that when the pregnancy has advanced beyond the fifth month, little benefit will be derived by the patient from the induction of abortion, since in any event the most dangerous period for the pregnant tuberculous woman will not be avoided. The puerperium will occur in any event, and the interruption of pregnancy in many cases only means shortening the life of the patient, for in advanced cases death is likely to occur at this time. Furthermore, although the life of the child is still of secondary

importance to that of the mother, nevertheless from the fifth month on, the fetus must receive more consideration than in the early months of gestation. After the fifth month of pregnancy, little can be accomplished beyond enforcing a strict general hygienic and dietary régime, and adopting the general treatment usually employed for the tuberculous. The indications for treatment are along general lines and every effort must be made to maintain the patient's strength and to improve her general health. Such patients are best treated in a sanatorium until the time for labor approaches. In mild or moderately advanced cases miscarriage or premature labor rarely occurs, but in advanced cases premature labor is not uncommon. As the time for delivery approaches, it is usually preferable to place these patients in a maternity hospital.

Some patients may stand the last few months of pregnancy well, but the risks are, however, great. In desperate cases, as a rule, the mother's condition is of secondary importance, as she is doomed in any event, and every effort should be directed toward establishing the well being of the child. The author has previously advanced the opinion that the high mortality among the infants of tuberculous mothers is due not to any congenital infection or special predisposition, but is chiefly the result of improper surroundings, faulty hygiene, bottle feeding, and the motherless condition of these children.

Delivery of Tuberculous Patients.—Attention has been previously directed to the dangers of labor for the patient suffering from pulmonary tuberculosis. To recapitulate, chief among these are muscular exertion, exhaustion, increased and sudden changes in the blood pressure, the possibility of breaking down healed or partially healed pulmonary lesions, resulting in the liberation of virulent tubercle bacilli into the blood stream, edema of the lungs, and the squeezing out of organisms into the general circulation from the placental site and hemoptysis. Polak and Matthews⁴⁹ state that mild cases going to term may be completed without causing alarm, while in advanced cases labor may be tedious, prolonged and fraught with many dangers to the mother, as, e.g., dyspnea, cough, hemoptysis, impending cardiac failure, pulmonary edema, pneumothorax, and, rarely, general dissemination of the infection through the lungs. These authors state that mild inactive pulmonary tuberculosis seems to have no effect per se upon the puerperium, hemorrhage is no greater and involution is not retarded. In the more active and progressive cases, there is apt to be excessive hemorrhage, and involution may be tardy. These ill effects are no doubt due to the general asthenic condition of the woman at this time. With these dangers in mind, the general principles of the conditions of labor and de-

livery can readily be formulated. The delivery should be conducted with two ends in view, the birth of a living child, and the expenditure of as little physical exertion and strain on the part of the mother as possible. Mild cases may stand labor well, but advanced cases are likely to be complicated by dyspnea, cough, hemoptysis, pulmonary edema, cardiac collapse, and pneumothorax. If the general condition is weakened, labor is slower, and the second stage is likely to be prolonged.

Occasionally, in patients desperately ill, it may be necessary to induce premature labor in the interests of the child.

In the mild quiescent case induction of premature labor is rarely indicated unless some obstetric complication exists, such as a contracted pelvis, etc. It should, however, be remembered that a decided effort should be made to shorten labor and to make it as easy as possible for the woman. With these points in view, premature labor, like the induction of abortion, should be performed after the seventh month for a lesser degree of obstetric complication than it should be in the non-tuberculous woman. Furthermore, these patients should not be permitted to go beyond the time. The induction of labor can be performed without anesthesia, and does not in itself aggravate the pulmonary lesion. It is, therefore, indicated, if the patient does not fall into labor at term, as the patient is thus spared the obstetric difficulties attendant upon the delivery of an oversized child. In cases exhibiting evidence of activity of the pulmonary lesion the induction of labor two weeks before term is generally advisable.

Cesarean Section.—This operation may be indicated as a life saving measure for the mother or for the child. In one case the author performed cesarean section on a mother nearly at term, who had advanced bilateral ulcerative pulmonary lesions and who, during the last month or two of pregnancy, suffered from frequent profuse hemoptysis. Slight coughing or exertion often produced marked hemorrhages. Four weeks before the date of her expected accouchement this patient was removed from The Henry Phipps Institute, where she had been bedfast for two months. Almost the first labor pains produced a hemorrhage. Cesarean section under spinal anesthesia was performed without loss of time, and a living infant was the result. The mother survived the operation nine months. In this case it is almost certain that, without operation, the mother would have died during the first stage of labor, and the infant would also have been sacrificed. The author has on two occasions performed cesarean section strictly in the interest of the child. In the first of these cases the mother was almost moribund; spinal anesthesia was employed, and the patient died while the abdominal

wall was being incised. The second case was one of advanced bilateral ulcerative lesions with frequent hemorrhages. This patient was in the worst possible physical condition, and it seemed certain that the physical exertion of labor, no matter how guarded, would result in death of the woman. The heart sounds were fairly good, and cesarean section under spinal anesthesia was performed. The woman survived the operation three months. In both instances, the infants were fortunately saved, both were well and apparently normal when six months old. Cesarean section should be performed only in desperate cases.

In the average case, the general indications are especial care and symptomatic treatment in the first stage of labor, and the use of the forceps during the second stage. Preparations for a rapid delivery should be made and the instruments sterilized and the operating room in condition, so that an immediate operative delivery can be performed at any stage, if it should become necessary. Assistants and nurses should be at hand. The author believes that even the shock of a cesarean section is preferable to permitting a pulmonary edema to become advanced. Naturally, such an operation should be performed only in the first stage of labor, and only under very exceptional circumstances. As a rule, no such radical measures are required.

If edema of the lungs sets in, labor must be terminated without delay, if either the mother or the child is to be saved. In the event of such an occurrence in the second stage of labor, extraction, either with the aid of forceps or by version, should be performed. No time should be lost, but the child should not be sacrificed by too great haste. It is likely that, in any event, the mother is doomed. The author makes it a routine measure in these cases, as soon as the labor pains become pronounced, to inhibit them with doses of morphin sulphate, usually gr. 1/16, given at frequent intervals to overcome at least the extreme severity of the pains. In no event should the drug be pushed to its physiologic limit. In a few cases a modified twilight sleep has been employed. After the completion of the first stage, operative delivery is generally indicated; at such times it may be necessary to administer the hypodermic more frequently, and occasionally even a few whiffs of nitrous oxide may be given. The latter should, however, be avoided if possible. Nevertheless, in most cases brief, light anesthesia is preferable to a prolongation of hard labor. In order, as much as possible, to minimize the dangers of a congenital infection in the child through the squeezing out of tubercle bacilli that may be present in the placenta, the cord should be ligated as soon as possible, and the interval of waiting for cessation of pulsation omitted.

Puerperium.—If the weather conditions are at all favorable, the puerperium should be passed out of doors. In any event, the break in the regular hygienic régime incident to labor should be as short as one as possible. Every effort should be directed toward improving the patient's general condition and maintaining her resisting powers. As soon as possible the patient should be removed to a well conducted sanatorium. Unfortunately, this is attainable only in a small proportion of cases. For the intelligent, and for those willing and able to adopt the proper hygiene and obtain efficient medical supervision, this is less necessary. It is, however, the poor and ignorant who especially require sanatorium treatment, and these are the patients who are, as a rule, unable to, and in some cases unwilling to, profit by it.

NURSING.—Breast feeding should be forbidden, and the infant should be kept in a separate and preferably distant room from the mother. Although this may be a great hardship for the woman, the less she sees of the child the better it is for it. The infant is put at once upon the bottle with a suitable milk mixture, or given a foster mother. The only treatment the mother's breast requires is a supporting bandage. This need not, and in fact should not, be too tightly applied. For the first day or two after the milk comes the breast will feel heavy and full. In a small proportion of cases this will be more than a discomfort, and will amount to actual pain; in the latter case a few small doses of morphin may be administered. An ice bag over the breasts usually does much to diminish the discomfort. After the second or third day following the appearance of the milk, no further discomfort is experienced, the flow of milk ceases and involution of the breasts sets in. Under no circumstances should massage or the breast pump be employed. These merely tend to prolong the period of discomfort. Tight bandaging increases the discomfort and has no effect upon the milk secretion. Belladonna and other local applications of similar character are of doubtful value. A dose or two of Epsom salts and moderate restriction of liquids are probably of benefit and may be employed for a day or two.

The Influence of Pregnancy upon Tuberculous Lesions Other Than Those of the Lungs.—Tuberculous lesions other than those of the lungs are frequently secondary infections, the primary focus being often situated in the lungs. For this reason a careful examination of the lungs should be made in every case. A negative chest examination and history, although it does not exclude a pulmonary lesion, at least shows that, if such a lesion is present, it is of limited extent and inactive and for practical purposes is not of sufficient gravity to influence the

prognosis very materially. Its possible existence should, however, be borne in mind, and an examination made at regular intervals to determine the pulmonary condition. In general, tuberculous lesions other than those of the lungs are less affected by pregnancy than are pulmonary lesions.

Tuberculosis of the osseous system is but little influenced by pregnancy. Pinard ⁵⁷ states that he has never seen a case of bone tuberculosis aggravated by pregnancy. The author has seen a number of such cases, including lesions of the hip and spine, none of which has been unfavorably influenced by pregnancy.

Tuberculous peritonitis, by involving the pelvic peritoneum, frequently results in sterility. Indeed, these patients are so ill that intercourse does not generally take place, and it follows that pregnancy is rare. Peritonitis may, however, develop during the course of pregnancy, but even here it does not appear to be of a more severe type than in the non-pregnant. Abortion and premature labor are not, however, infrequent. Schmidt ¹¹⁰ has recorded the results obtained from the operative treatment of 37 cases of peritoneal or genital tuberculosis, and in each case these results were excellent. Delassus ¹¹¹ reports the history of a remarkable case. The patient, who was 29 years of age, was operated upon for a tuberculous peritonitis. Later, the abdomen was opened during the course of a herniotomy, at which time the peritoneal condition was found to be improved. Eighteen months later she was delivered spontaneously of an 8-pound infant. Benestad ¹¹² has recorded the history of a case of acute tuberculous peritonitis occurring during the puerperium. Oppenheimer ¹¹³ states that women who have had a nephrectomy performed for renal tuberculosis and subsequently become pregnant run a decided risk not only of kidney insufficiency, but, if a tuberculous cystitis persists, the infection may spread rapidly to adjacent organs. Esch (quoted by Davis ³⁰) has seen such patients stand the strain of pregnancy well. Davis reports a case in which eclampsia occurred. The patient survived, however, and was in good condition one month later.

TREATMENT.—As a general rule, cases of tuberculosis affecting other portions of the body than the lungs should be treated along general surgical lines. In all cases hygienic and dietary measures are of prime importance. From the surgical aspect, intervention may be required. In the event of an acute exacerbation of the lesion, the induction of abortion may be indicated, just as it may in any other disease. The benefits to be derived from it are, however, much more questionable than when the lungs are attacked. Should pulmonary symptoms be-

come manifest, the treatment is the same as that previously suggested under the head of pulmonary tuberculosis and pregnancy. During labor the cases should be carefully guarded and every effort made to conserve the patient's strength. To this end, forceps should usually be employed during the second stage of labor and measures be taken to prevent undue exertion and exhaustion. As a general rule, these mothers should not nurse their infants; the safer plan, for both mother and child, is to institute artificial feeding at once.

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CHAPTER XII

MENSTRUAL DISTURBANCES IN CONJUNCTION WITH PULMONARY TUBERCULOSIS

Classification according to types—General considerations—Etiology—Theories advanced—Later observations—Chief indication for treatment—Dysmenorrhea—Clinical reports—Use of tuberculin—Scanty menstruation—Statistics—Irregular scanty flow—Amenorrhea—Cases studied—Menorrhagia—Vicarious menstruation—Periodic hemoptysis—Cases cited—Leukorrhea—Influence of menstruation on temperature in pulmonary tuberculosis—Cause—Consideration—Precautions instituted—Bibliography.

GENERAL CONSIDERATIONS

Menstrual disturbances frequently occur in conjunction with pulmonary tuberculosis. As a general thing, they tend towards a lessening of the loss of blood, increase in pain, or both. The disposition towards a scanty flow may occur at any time during the course of the pulmonary disease, but is most frequent in advanced or acute cases. Dysmenorrhea, on the other hand, is common, even in the early stages of the disease. In 234 ambulatory cases of pulmonary tuberculosis observed by the author, all of whom were free from pelvic disease, and whose ages vary from 17 to 39 years (the average being 28 years), the following menstrual disturbances were observed:

	Per cent
Normal	23
Abnormal	77
Dysmenorrhea	72
" severe	30
Scanty flow, fairly regular	53
Irregular, scanty	10
Amenorrhea	5
Menorrhagia	0.8
Vicarious menstruation	0.43

Macht's ¹ findings are in accord with our own. *Classified according to the ordinary types of menstruation, Macht found:*

	Per cent
Regular, no change in	51.6
Amenorrhea (scanty or complete)	27.3
Irregular (some menorrhagia or amenorrhea)	8.3
Menorrhagia	4.6
Pregnant (in which amenorrhea could be ac- counted for on grounds other than tuber- culosis)	4.4
Menopause (artificial or otherwise)	3.8

In considering the menstrual disturbances resulting from pulmonary tuberculosis, it is important to remember that even in the normal woman the standard is a variable one; what is normal for one individual may readily be abnormal for another. Dysmenorrhea is also a relative symptom, the amount of pain which will keep one patient in bed may be but little complained of by another. The patients comprising our series have all been personally interviewed by the writer and particular care has been exercised to obtain an accurate menstrual history. It should be stated that some of the cases of diminished flow gave a history of a previous period of increase in flow, as a rule preceding for a short period the lessening of the flow.

Etiology.—Before considering in detail the various menstrual disturbances, a study of their etiology is advisable. At the outset it must be remembered that not only are many of these symptoms, such as dysmenorrhea, scanty flow and menorrhagia, relative symptoms, for which the normal standard can be obtained only by studying the individual patient, but also that, even when pathologic in their degrees, they are present more or less frequently in otherwise healthy non-tuberculous women. For this reason special care must be observed in classifying the various symptoms, and judgment must be exercised before declaring that in any given case the menstrual disturbance is the result of tuberculosis. Needless to state, all cases in which there are distinct pelvic lesions should, with possibly one exception, be excluded. The possible exception is of those cases of pulmonary tuberculosis suffering from menstrual disturbances and complicated by hypoplasia of the genital organs. Whether or not there is a relationship between hypoplasia of the genital organs and tuberculosis will be considered subsequently.

All patients were excluded from this series who were suffering from a combination of tuberculosis and some other disease when the character of the latter might in itself influence menstruation.

The following theories have been advanced to account for the menstrual disturbances which occur in these patients:

(1) Thorn,² from a study of uteri from tuberculous patients, believes that he has found an almost uniform atrophy of the uterus with degenerative changes in the blood vessels, in general, similar to those present in the senile organ.

(2) That the menstrual changes are the result of a toxemia or analogous condition, which reacts upon the ductless glands, resulting in ovarian changes, either histologically or physically. Butner³ believes that the menarche of the tuberculous girl is delayed or absent, not because of an economic anabolism or conservatism of nature, but rather from a catabolic toxin being elaborated by the growth of the tuberculosis, which has a selective action in some unknown way over menstruation, probably by the influence of the toxin on the internal secretion of the ovary.

(3) That pulmonary tuberculosis, when occurring in early life, tends to prevent the complete development of the genital organs, so that many of these patients have hypoplasia of the uterus, of the ovaries, or both.

(4) That the menstrual disturbances are the result of a poor general condition incident to the tuberculosis, such as anemia, hydremia, general loss of strength, etc.

Regarding the first theory, the author's studies have not confirmed the findings of Thorn. The more modern view, that in general the uterus is of secondary importance to the ovary in the function of menstruation, is apparently based upon a firmer scientific basis than is the older view that the uterus is chiefly to blame for abnormal changes in the menses.

In regard to the second theory, De Jong⁴ has studied the ovaries from a large series of tuberculous women and finds the external appearance of the ovary in these patients to be variable; it may be smooth or furrowed. Comparison of the ovaries of tuberculous and non-tuberculous women shows that there is no marked difference in size, but the weight of the former is less. Tuberculosis does not affect the number of primordial follicles, nor does it destroy them. De Jong does, however, believe that to some extent it prevents their proper development. This results in a lessened number of corpora lutea. This may, in part, account for the scanty menstruations and dysmenorrhea so common in these patients, as it is accepted that the luteum cells exert a definite influence upon menstruation.

Poncet and Leriche⁵ believe that many of the sclerotic lesions in

the pelvis are due to tuberculosis occurring in early life, such as micro-polycystic degeneration of the ovaries, fibrosis of the uterus, hydrosalpinx, and hypoplasia. The amenorrhea and other menstrual disturbances, they believe, are a direct manifestation of the disease and not merely the result of a general dyscrasia.

Sessa,⁶ in the study of the changes in ovaries of children resulting from infectious diseases in children under 5 years of age, dead of acute or chronic infectious diseases, and who had exhibited no symptoms suggestive of ovarian disease, found no macroscopic change in the ovary. Microscopically, more or less pronounced changes were observed. In tuberculous patients there were generally interstitial changes with more or less infiltration by chronic inflammatory products.

Gräfenberg,⁷ Schiffman⁸ and others have pointed out the frequency with which underdeveloped uteri are present in these cases. Hegar, Merlitti,⁹ de Rouville,¹⁰ and others have emphasized the frequency with which genital tuberculosis occurs in hypoplastic organs. As genital tuberculosis is, in 90 per cent of cases, a secondary infection, these latter observations have definite bearing upon the subject under discussion.

In the entire series of 234 cases constituting the author's study, 11 patients had what might be termed "infantile uteri." Of these 9 exhibited more or less scanty flow, and 8 definite dysmenorrhea. Hypoplasia of organs other than the genital tract is not especially frequent in the tuberculous. Furthermore, hypoplasia in the non-tuberculous is relatively a frequent condition. To prove this theory it would, therefore, be necessary to show that hypoplasia of the genital organs was more frequent in the tuberculous than in the non-tuberculous. Naturally, hypoplasia of the genital organs can only be attributed to tuberculosis when the infection has originated at a period prior to that in which the development of the genital organs occurs. The generally accepted theory that many cases of pulmonary tuberculosis are the result of infection in early life, and only become manifest later, is, however, to be considered. It appears, moreover, improbable that hypoplasia of the genital tract should be attributable to these early infections, which are inactive. It is possible that a moderately active tuberculosis occurring at a period during or prior to the development of the genital organs may have some inhibiting action on the development of the uterus or ovaries. This, however, is not yet proven.

The fourth theory, that the menstrual disturbances are the result of a general malnutrition, appears to afford the most probable explanation in the majority of cases. It is true that some patients, especially

those suffering from dysmenorrhea, are often in comparatively good condition and exhibit little anemia. The majority of tuberculous patients are distinctively below par, and often show more or less blood changes. Practically all the anemias produce menstrual disturbances. The menstrual disturbances usually accompanying chlorosis are in general strikingly similar to those occurring in tuberculosis. All the infectious fevers are prone to produce menstrual changes; menstrual disturbances are, therefore, only what would be expected in tuberculosis. It is probable that the menstrual disturbances resulting from pulmonary tuberculosis may be the result of a number of conditions, and that either the toxemia theory, or the general malnutrition theory may be applicable to certain cases. From our own findings we attribute little weight to the theory based upon a hypoplasia of the genital tract. In our series hypoplasia has been present, but not more frequently than might be expected in a series of non-tuberculous patients.

Especially is it important to emphasize the fact that menstrual disturbances are more likely to occur in women under 35 years of age. If the pulmonary lesions become manifest after 35 years of age, severe menstrual disturbances are less frequent. In those in whom the tuberculosis has appeared earlier, menstrual disturbances are likely to be somewhat lessened after this age. An early menopause is frequent in the tuberculous. In tuberculous girls the onset of menstruation is often delayed.

Treatment.—As menstrual disturbance is so frequent in the tuberculous, these patients should be especially guarded at the time of the flow. The chief indication for treatment in all these cases should be directed towards the pulmonary condition, as it follows that, if the cause of the disturbance can be improved, the menstrual abnormality will tend to improve.

As a general rule, they are better in bed for a few days prior to the flow, and for the first day or two of the menstrual period. The bowels should be regulated with great care, and if there is a tendency towards dysmenorrhea, especially if it is of the congestive type, a brisk purge is advisable. In cases of excessive flow, care should be observed to conserve the strength by checking an abnormal loss of blood. Without exception, all such cases should be confined to bed during the period of greatest bleeding. Unfortunately many women suffering from tuberculosis are, on account of their social surroundings, unable to stay in bed for two, three, or more days each month. Nevertheless, these patients should be advised against physical exertion at these periods, and if they cannot stay in bed or spend considerable portion of the time

upon a couch, should at least endeavor to guard against undue exertion.

Dysmenorrhea.—In the series of cases studied from which these conclusions have been drawn, 72 per cent of patients complained of more or less dysmenorrhea. This in itself is not an unusual proportion. The researches of Tobler,¹¹ Schaffer,¹² and others have shown that at least 70 to 75 per cent of otherwise normal women suffer more or less at the time of the flow. Schaffer found that dysmenorrhea severe enough to be classified as pathologic was present in 14 per cent of his cases. That 30 per cent of our series suffered from severe dysmenorrhea is, however, excessive.

This latter group, consisting of 70 cases, was studied as to the type of dysmenorrhea present, with the following results: 5 cases were of a purely obstructive type of dysmenorrhea, i.e., the pain appeared simultaneously with, or a few hours before, the onset of the flow, was cramp-like or expulsive in character, often simulating miniature labor pains, frequently temporarily relieved by the expulsion of a clot, and was most severe for the first third of the menstrual period. Forty-eight were plainly congestive in type, i.e., the pain began some time before the onset of the flow, in some instances two or three or more days, was of a dull, heavy aching character, experienced over the lower abdomen, sides, and back, and sometimes extending into the thighs, usually somewhat relieved after the first day or two of the flow. The remaining 17 cases were of a mixed type and could not be classed as either pure congestive or expulsive dysmenorrhea, neither one nor the other type predominating sufficiently to warrant classifying them with any degree of certainty. In the majority, however, the congestive symptoms were the most marked, the congestive type in the characteristic variety of dysmenorrhea resulting from tuberculosis. Simple dilatation or splitting of the cervix is a failure in this type of case, as there is no stenosis of the canal, and, therefore, no indication for such an operation.

Of our 70 cases of dysmenorrhea, 58 were under 35 years of age. As already stated, the characteristic type of tuberculous dysmenorrhea is the congestive type, and occurred with sufficient severity to constitute a definite symptom in one-fourth of all our cases. In not a few of our cases, dysmenorrhea has been the symptom of which the patient complained more than any other. In one patient it was so severe that on one occasion she attempted self-destruction. In 48 per cent of our cases, the dysmenorrhea appeared early in the course of the tuberculosis, in this confirming the findings of Macht,¹ who observed 45.8 per cent of his cases of tuberculous dysmenorrhea develop during the first stage of the disease. Hollos and Eisenstein¹³ found dysmenorrhea an

early symptom in tuberculosis. They point out the frequency with which it is present and urge a physical examination of the chest in all patients suffering from this symptom.

In nearly half (48 per cent) of our cases the dysmenorrhea appeared early in the course of the disease, and is, therefore, a sign of some diagnostic importance, and should suggest the possibility of tuberculosis being present in all patients suffering from dysmenorrhea. This is a point which should be emphasized. In not a few cases dysmenorrhea is the chief symptom and will be the one from which the patient will seek relief. If an examination of the chest is not made and only the ordinary treatment for dysmenorrhea instituted, not only will the latter be unaffected, but the lung lesion may be given time to advance, and, if a dilatation under ether is performed, the latter may be the means of causing an exacerbation of the pulmonary condition.

EXPULSIVE DYSMENORRHEA.—All tuberculous patients suffering from dysmenorrhea must be studied individually. When found suffering severely from a definite obstructive type of dysmenorrhea, in some instances a dilatation operation may be performed. Operative relief should, however, be withheld, unless the dysmenorrhea is of an unusually severe type and the pulmonary lesion mild. In other words, these cases are to be treated as any other surgical case, complicated by a pulmonary tuberculosis. Dysmenorrhea is never a fatal symptom, whereas operative intervention may be the means of lighting up the pulmonary condition. This type of dysmenorrhea is not of tuberculous origin and occurs merely incidentally in tuberculous subjects.

CONGESTIVE DYSMENORRHEA.—A more or less pure congestive type is common, and is frequently of sufficient severity to require treatment. Our experience at the Henry Phipps Institute in Philadelphia has shown that in general the severity of the dysmenorrhea waxes and wanes with the exacerbations or improvement of the pulmonary condition. If it is possible to build up the patient's general condition, so that she will show steady gain in weight, increased hemoglobin, etc., the dysmenorrhea becomes less marked, whereas in the presence of an active pulmonary lesion and the patient generally going down hill, the dysmenorrhea is likely to become worse.

TREATMENT.—The treatment of these patients should be along the lines of the treatment instituted for the tuberculous. Because the dysmenorrhea is prone to develop early in the course of the tuberculosis, and may in some cases be temporarily the dominant symptom, and because of the general tendency of surgeons and others to perform dilatative operations on all cases of dysmenorrhea, regardless of their origin or

type, it is of the utmost importance that tuberculosis be excluded before any operative measures are attempted. Eisenstein and Hollas¹² report that among 70 cases of dysmenorrhea, in 23 tuberculosis was demonstrated. Gräfenberg⁷ reports that at the Kiel Clinic all cases of dysmenorrhea are examined for tuberculosis, and not only is a physical examination performed, but the tuberculin test is also employed. Of 30 patients tested by the latter means 21 reacted with fever, and all gave a general reaction attended with local exacerbations of the trouble for which they applied to the clinic. Gräfenberg states that, should the test be followed by a general and local reaction, no operative intervention should be attempted, and quotes Prochownik's warning against curettage in cases of genital tuberculosis. He states that where there is no local reaction to the tuberculin test, operation may be safely employed.

Operation offers little hope of relief in the congestive type of dysmenorrhea, regardless of its primary origin, and in the tuberculous cannot by any means be regarded as free from danger. Gräfenberg calls attention to the frequency with which tuberculous patients in poor general condition suffer from dysmenorrhea. Eisenstein and Hollas¹³ found a positive tuberculous skin reaction present in a large series of women suffering from menstrual disturbances. The latter observers report that in 22 cases of dysmenorrhea treated with tuberculin by the Spengler method, 16 were cured. The results in amenorrhea were reported as even more satisfactory.

The author's experience with tuberculin has been too limited to draw conclusions from it. In the great majority of cases, if the general health can be improved, the dysmenorrhea will improve. During the carrying out of the general hygienic and dietary treatment, these patients should have special treatment during the menstrual and pre-menstrual periods. At these times the patient should be confined to bed, or at least to a reclining chair. One or two purgations, accomplished either by Epsom salts or castor oil, are often of benefit in relieving the dysmenorrhea. These should be given so that they will act during the height of the pain. A warm soapsuds enema administered at this time is also of benefit. Hot applications to the lower abdomen also relieve pain. In severe cases small doses of phenacetin may be tried. Opium or its derivatives should be avoided, except under very exceptional circumstances.

Scanty Menstruation.—Scanty menstruation was found to be present in 53 per cent of our series of cases. Friedrich¹⁴ observed scanty menstruation, or complete amenorrhea, in 65 per cent of a series of 200 tuberculous women. In tuberculous patients with hypo-plastic uteri the flow is scanty from the onset of menstruation and manifests itself by a

short period and scanty flow. The first 6 or 8 months after the beginning of menstruation, the periods are frequently delayed, the individual often menstruating but three or four times in the 6 or 8 months after the first menstrual period. The age of onset of menstruation in these patients is often somewhat later than normal. Galop¹⁵ found that menstruation was established late and that a premature menopause frequently occurred.

The tendency for scanty flow is very marked in pulmonary tuberculosis. Sometimes this manifests itself by scanty flow, by short periods, by delayed periods, and even, in exceptional cases, by complete amenorrhea. Frequently the scanty flow is preceded for a few months by menorrhagia. Scanty flow is not only common in those cases in which there is hypoplasia of the uterus, but in those cases in which the uterus is normal the flow usually is scant, if the pulmonary disease is active, and especially so if the general condition is poor.

Scanty menstruation is in itself a symptom which rarely causes the patient much concern. It may be considered an effort on the part of nature to conserve blood and thus maintain the strength and resistant powers of the patient. Unfortunately, scanty menstruation is usually accompanied by dysmenorrhea, sometimes of a severe type, and for this reason the patients require treatment. Dysmenorrhea was an accompaniment of scanty menstruation in 88 per cent of our series. Macht,¹ who apparently classifies scanty menstruation under amenorrhea, found that a large proportion of those cases occurred in young women. Macht's table is as follows:

Under 20 years of age.....	32.5 per cent
20 to 30	39.0 "
30 to 40	23.9 "
Above 40	4.6 "

Macht gives the following table showing the stage of the pulmonary lesion:

1st stage	45.0 per cent of 42 patients
2d. stage	14.0 " "
3d stage	23.7 " "
Patients reported dead at time of computing statistics..	16.5 " "

Friedrich,¹⁴ in the series of 200 patients studied, found scanty menstruation or complete amenorrhea in the following proportion of cases:

1st stage	45	per cent of	42	patients
2d stage	64	"	90	"
3d stage	85	"	68	"

This report, while emphasizing the fact that scanty menstruation is common in the early stages of tuberculosis, also shows that, as the disease advances, the menstrual disturbances become more frequent. This is in accord with the author's observations.

TREATMENT.—Scanty menstruation in itself requires no treatment. If the general health of the patient can be improved, the flow usually becomes more normal. Corpus luteum extract is of value in some cases. The trial of extract should be begun about 15 or 20 days before an expected period, administering 5 grains 3 times a day and increasing 1 pill daily until 20 or 30 grains are taken in 24 hours. If organotherapy is to be of value, it proves itself so in the one treatment. If no benefits are derived, it is generally useless to repeat it. If the period is increased or the dysmenorrhea relieved, it may be repeated each month. Of chief importance is treatment directed along the lines of improving the general health.

Irregular Scanty Flow.—This was present in ten per cent of our cases. In the advanced stages of pulmonary tuberculosis it is a frequent symptom, but may occur early.

Amenorrhea.—Complete absence of menstruation, either of the primary or secondary type, was present in 5 per cent of our series. Friedrich¹⁴ believes it a common symptom of pulmonary tuberculosis. This symptom frequently causes mental distress to the patient. In many cases all the subjective phenomena of menstruation are present, except bleeding. The secondary type frequently gives a history of scanty or irregular bleeding for a time preceding the complete cessation of the flow. This is a not infrequent symptom in advanced cases of pulmonary tuberculosis.

TREATMENT.—This should be directed towards the improvement of the general condition. Corpus luteum extract is occasionally of value in the treatment of these cases. In the married woman pregnancy must be excluded. It must also be remembered in this connection, as well as with scanty flow, that the menopause occurs somewhat earlier in tuberculous than in non-tuberculous patients. In a series of 21 patients in various stages of pulmonary tuberculosis, studied by the writer, the average age of the onset of the menopause was found to be 41 years. The average in non-tuberculous patients is about 47 years (Norris¹⁶).

Menorrhagia.—Menorrhagia was present in 8 per cent of our series

of cases. It is prone to occur in conjunction with those cases in which there is an irregular periodicity of flow. It rarely persists for prolonged periods, and frequently is followed after a few months by scanty flow, which persists. In some of our cases excessive flow was accompanied by marked dysmenorrhea.

Menorrhagia rarely occurs after 30 or 35 years of age, unless associated with a local lesion. It is not infrequently an early symptom of tuberculosis. This symptom was commented upon by Handforth¹⁷ as early as 1887.

TREATMENT.—Like other menstrual disturbances the results of tuberculosis, the treatment should be directed towards the pulmonary condition, and if this can be improved, the menstrual disturbances usually become normal. If, as in some of our cases, the flow is excessive, the patient should be kept in bed during the bleeding, and ergot or pituitrin administered. Rest in bed is usually sufficient to control the bleeding. Excessive flow is to be combated more vigorously in the tuberculous than in the non-tuberculous, on account of the necessity for conserving the strength and resistant powers of the patient.

If it is evident that the flow should be checked, this can be done by radiumization, small doses being employed so as to avoid the permanent menopause. By carefully graduated doses amenorrhea can be produced for a few months, and when the flow is reestablished, it is often normal in amount. Guillermin¹⁸ recommends permanent sterilization and the production of the menopause by the roentgen rays in some cases. Whereas sterilization may be advisable in some cases, the production of the artificial menopause has definite disadvantages, and should be employed only in carefully selected cases.

Vicarious Menstruation.—In our series of 214 cases vicarious menstruation was present in 1 patient. This case was moderately typical. Macht¹ believes it more common than generally thought and observed 15 cases in her series. In our case menstruation was normal until 22 years of age. Tuberculosis became manifest at 20 years of age. The patient was in the first stage of the disease, which was, when first seen, quiescent, although the history indicated periods of mild activity. The patient was in moderately good physical condition, and there was no other demonstrable cause for the menstrual phenomena, the genital tract being apparently normal. At 22 years of age and in the second year of her tuberculosis, the menstrual periods became somewhat more profuse than formerly. This continued irregularly, one or two periods being profuse and another scant for six months. Then the periods became very scant and lasted only one day. At time for the flow, there was a hemorrhage

from the bowel sufficient to necessitate wearing a pad, the blood being bright red and the bleeding painless. There was still a show of blood per vaginam for the first day. The bleeding per rectum continued intermittently for two or three days. The usual menstrual phenomena, tingling in the breast, etc., continued. Proctoscopic examination showed the rectum normal. The periodic bleeding from the bowel continued for six months and then ceased.

Periodic hemoptysis in tuberculous patients has been frequently observed, not only in women, but also in men. Huguenin,¹⁹ Macht,¹ and others record the histories of cases in which hemorrhages have occurred more or less regularly at varying intervals. In considering vicarious menstruation, it is important, however, to exclude all accidental or coincident hemorrhages. It is probable that many cases of supposed vicarious menstruation are incorrectly diagnosed. Macht¹ states that periodic hemorrhages at the menstrual periods have been recorded by Tiedman,²⁰ Scherer,²¹ Kober,²² Davis,²³ Flesch,²⁴ Ford,²⁵ Schlippe,²⁶ Mosig and Stern,²⁷ and others. In our case the bleeding was slight; it may, however, be profuse. Macht¹ records a case of Dr. Brown's, in which the patient bled to death, despite the fact that there was improvement in the pulmonary condition. Flesch's case also terminated fatally.

Vicarious menstruation may occur from any mucous membrane. Hemorrhages from the nose, throat, lungs, alimentary tract, kidney, breast, lips, have been observed by Hauptman²⁸ and Ventura.²⁹ Macht³⁰ records the history of a case which bled regularly from an ulcer in the breast.

TREATMENT.—This is similar to that indicated for amenorrhea and scanty menstruation. If the amount of flow per vaginam can be brought up to the normal, the vicarious bleeding usually ceases.

Leukorrhœa.—Gallard³¹ has referred to the occurrence of periodic leukorrhœa. Leukorrhœa in general is usually more profuse just before and after menstruation. Our investigations have not shown that leukorrhœa is either more frequent or profuse in the tuberculous than in the non-tuberculous. No periodic leukorrhœa other than the type above mentioned has been observed.

The Influence of Menstruation on the Temperature in Pulmonary Tuberculosis.—As early as 1878, Goodman,³² and later von Ott³³ and others have demonstrated that definite changes occur in the woman at the menstrual period. These changes are not only local, but affect more or less the entire economy. Goodman, von Ott, and others believe that among other changes for a few days prior to the appearance of the menstrual flow there is a slight rise in temperature, in pulse rate,

respiration, and the entire nervous system is somewhat more sensitive at this time. When the flow becomes established, all these conditions suddenly drop to a point somewhat below the normal line, from which time there is a gradual rise until the next menstrual period. An increase in temperature is, however, seen in many cases apparently normal.

In considering the rise of temperature which often occurs at the menstrual period in pulmonary tuberculosis, the so-called Goodman-von Ott wave must be taken into consideration. From the observations of others, and from our own studies, however, it seems established that in the tuberculous the tendency towards a rise in temperature is considerably above that present in the normal woman. This rise in temperature is of distinct diagnostic importance. According to Kraus,³⁴ it occurs in 66 per cent of cases. Weisse³⁵ observed a premenstrual rise in 40 per cent of cases. Only 32 per cent had normal temperature during menstruation. Hansen³⁶ observed a premenstrual or menstrual rise in temperature in the majority of cases. The increase in temperature is thought to be due to a certain degree of exacerbation of the pulmonary condition, which is explained by a hyperpyrexia of the lungs. Macht¹ states that at the menstrual period all symptoms exhibit a tendency to become worse. Cough, expectoration, anorexia, general malaise, etc., become more manifest, while laryngeal involvement is prone to spread and physical signs become more marked. The exacerbation is usually transient, but may continue. Taking a basis of 99°F. as the standard, Weisse³⁵ found that 13 per cent of patients had a menstrual rise of temperature usually on the first day of flow, at times continuing over the second; (10 per cent in the first stage of tuberculosis, 15 per cent in the second stage, and 17 per cent in the third stage). Weisse's statistics were formulated from a series of 500 cases of active pulmonary tuberculosis. Riebold³⁷ found a rise in 12 per cent of cases. Sabourin³⁸ found the rise in temperature a frequent symptom. Scherer²¹ observed a rise most frequently in advanced cases. Noncher,³⁹ whose paper contains a valuable bibliography, found a rise in temperature in either the premenstrual or menstrual periods in 50 per cent of cases, Kraus³⁴ in 66 per cent, Macht¹ in 40 per cent. Van Voornveldt⁴⁰ has recorded a case in which there was a regular intermenstrual rise which may be somewhat analogous to the *mid schmerchen* occasionally observed. As seen from the above figures, the premenstrual rise is the most frequent. Postmenstrual rise of temperature was observed in but 24 per cent of cases and is an unfavorable sign.

This rise in temperature may occur in otherwise normal, or may manifest itself as a higher rise in temperature at the menstrual period in

those patients who are experiencing more or less fever. The fever is generally highest in the evening.

The rise in temperature may be present in mild as well as in advanced cases. Geisler's⁴¹ suspicion was in one case first aroused towards an incipient lung lesion by these symptoms. A marked rise in temperature is usually an indication of an active lesion, and is an unfavorable prognostic sign. So frequent is a slight rise in temperature, that this symptom should warn of possible presence of pulmonary tuberculosis and calls for an examination. A previously silent case may give positive findings at or just before the menstrual period. The rise in temperature at the menstrual period in tuberculous women has been the subject of considerable study, papers having been devoted to it by Mantoux,⁴² Riebold,³⁷ Sabourin,³⁸ Kraus,³⁴ Scherer,²¹ Pel,⁴³ and others.

Pregnancy, even in the early stages, not infrequently exerts an unfavorable influence on the course of pulmonary tuberculosis. When it is considered how closely the early stage of pregnancy resembles the physiologic process incident to menstruation, the etiologic relationship of the exacerbation which sometimes occurs at the menstrual periods can be readily understood. Menstruation may be viewed as a preparation of the genital tract for the implantation in the uterus of the fertilized ovum. The same congestion of the genital tract, the thickening of the endometrium, the nervous phenomena, are common to both conditions and are the same as occur in pregnancy, but to a lessened degree. Menstruation has been well termed the abortion of the unfertilized ovum.

From a practical viewpoint, the fact that at the menstrual period pulmonary tuberculosis is especially prone to exhibit exacerbations calls for especial care of all patients at this time. Rest in bed, or at least the reducing of all physical exertion, is of prime importance at this time. If dysmenorrhea or other menstrual disturbances are present, rest will serve a double purpose.

All factors which are prone to exert an unfavorable influence on the pulmonary lesions should be avoided as much as possible. Thus, especial care should be exercised against "taking cold." Overheating should be avoided and the diet and bowels should be carefully regulated. These precautions should be instituted for a few days prior to, and for the first few days of, the flow. Such precautions are indicated in all patients suffering from pulmonary tuberculosis, but are especially called for in those patients who exhibit a rise in temperature at, or prior to, the menstrual periods. Macht¹ and other authorities warn against the administration of tuberculin at this time. Owing to the tendency toward exacerbations of the pulmonary lesions at this time, operative intervention of

all kinds should be avoided. This applies to cases of frank pulmonary tuberculosis, and also to suspected or incipient ones, thus including all tuberculous lesions of the genital tract, which are, in the majority of instances, secondary to pulmonary tuberculosis.

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CHAPTER XIII

PULMONARY TUBERCULOSIS AND OPERATION

Three distinct dangers—Choice of anesthetic—Classification of pulmonary tuberculosis based on physical findings and constitutional symptoms—Subdivision into groups—Study of different stages of the disease—Spinal anesthesia—Precautions before operation—Importance of expert anesthetist—Convalescence—Results—Condition of pulmonary lesion six or more months after operation performed under general anesthetic—Statistical report—Bibliography.

CLASSIFICATIONS

Pulmonary tuberculosis is one of the most frequent diseases to which mankind is heir. When it becomes necessary to subject a patient suffering from this form of infection to operation, the individual so treated is exposed to materially greater risk than is the non-tuberculous patient. Three distinct dangers occur, which are not present in the non-tuberculous patient: (1) the operation itself may be the means of disseminating the infection either to distant and hitherto uninfected parts of the body, or it may result in an exacerbation of the pulmonary process; (2) if a general anesthetic is employed, this may light up the pulmonary lesion; and (3) to these dangers are added the fact that the tuberculous patient is generally below par, and possesses lessened resistant powers, and is therefore less able to withstand the dangers common to operation. When a general anesthetic has been employed and ill results follow, it is sometimes difficult to determine whether these are the results of the anesthetic or the operation.

From a practical standpoint, however, it is safe to assume that all tuberculous patients are less favorable operative risks, and operations upon them are followed by greater morbidity and a higher mortality than in non-tuberculous patients. As the risks are greater, the indications for operation should be well defined. In considering the subject, it is necessary to individualize all patients. Naturally, the graver the pulmonary lesion, the greater are the dangers incident to operation, and the more urgent should be the necessity for operation, before such is advised. Thus, in mild quiescent pulmonary lesions, operations may be advised to

do away with some discomfort which would never threaten the life of the patient, such, for instance, as a laceration of the peritoneum which is producing definite symptoms; on the other hand, operation would never be justifiable for a similar gynecological lesion in a patient the incumbent of an advanced or active pulmonary tuberculosis. In the case of an operable cancer, however, great risks are justifiable, as it is known that the patient is doomed if the tumor is not removed, whereas the pulmonary lesion, even if advanced, may possibly be checked and held in abeyance for years, or even cured.

Various classifications of pulmonary tuberculosis have been suggested; one of the most satisfactory is that of the American Medical Association, which depends upon a combination of the physical finding and the constitutional symptoms. This classification divides pulmonary tuberculosis into three stages.

In Stage I are placed all incipient cases and those which present slight or no constitutional symptoms. The temperature is not over 100.5° F., pulse under 90, expectoration not more than 30 c.c. in the twenty-four hours. Physical signs limited to infiltration above the clavicles, if bilateral, or to above the second rib, if unilateral.

Stage II comprises the moderately advanced cases. In this stage there are no marked local or constitutional symptoms. Marked dyspnea, extreme weakness, anorexia, tachycardia, are constitutional symptoms excluding the patient from this class. Physical examination must show that, if unilateral, not more than half of one lobe is involved; if bilateral, involvement even less, and there must be only slight or no evidence of cavity formation.

Stage III includes far advanced cases, all those in which there are marked constitutional symptoms, and all those in which the physical examination shows consolidation of more than one lobe of the lung; if unilateral, advanced cavity formation, or all those cases which are advanced beyond Class II. Miliary tuberculosis is classified separately. It has been our experience that physical signs generally rather underestimate the extent of the pulmonary lesion, and this is in accord with the statement of Brown.¹

First Stage.—In our work we have subdivided this class of cases into two groups. The first (group A) comprises those cases which are practically free from subjective symptoms, and the only indication of a pulmonary lesion is that there are present slight physical signs and a suggestive history. To this group is added all cases of tuberculosis of the genital tract which present no evidence of pulmonary lesions beyond the fact that we know nearly all genital lesions are secondary and that,

where there is no other demonstrable primary lesion, it is probable that the lungs were the primary seat. It is true that by treating this latter class of cases as if they were the incumbents of a pulmonary lesion it is probable that a few primary genital lesions are included. However, this is erring on the side of safety.

Patients presenting no subjective symptoms and only mild, quiescent or even suspicious physical signs stand even a general anesthetic well, and while the indication for operation should be somewhat greater than in those patients with normal lungs, nevertheless the risk is so slight that it is unjustifiable to allow these patients to suffer when operation offers a reasonable hope of cure.

Group B consists of patients in Stage I who are exhibiting symptoms such as mild cough, expectoration, slight fever, or a little acceleration of pulse. In these a decidedly more cautious attitude should be assumed. In this class of cases Brown's warning that the physical signs often underestimate the pulmonary lesions should be borne in mind. The administration of ether to such a patient, while in the majority of cases is harmless, will, however, in a certain percentage of cases be the agency which will light up the pulmonary lesion or produce an extension of the disease. With this group of cases, therefore, when the surgical condition permits, it is preferable to advise a course of preliminary treatment in an endeavor to improve their pulmonary condition so that it will come under Group A. If this is impossible and operation is demanded, the patient should receive a preliminary dose of morphin gr. $\frac{1}{4}$ to $\frac{1}{3}$ with atropin gr. $\frac{1}{150}$. Local anesthesia is the anesthetic of choice, and much may be done under local anesthesia, if a careful technic is developed. If the entire operation cannot be performed under local anesthesia, it may be supplemented with nitrous oxid, which is decidedly preferable to ether. If deep anesthesia and relaxation is necessary, a few whiffs of ether may be employed during that stage of the operation in which it is required. Its use should be avoided if possible, and only enough given to obtain the desired effect, and a switch back to nitrous oxid made as soon as the conditions permit. Patients in Group A, Stage I, are treated as if in Group B, except that the operative indications are less strictly drawn and there is less hesitancy in resorting to a general anesthetic.

Second Stage.—The indications for operation should be well defined, and, with few exceptions, operative intervention requiring a general anesthetic should be refused to patients in this stage of tuberculosis, unless surgical intervention is demanded as a life saving measure. The administration of a general anesthetic is extremely hazardous, and ether especially dangerous. In this stage of the pulmonary disease every effort

should be made to employ only a local anesthesia. The preliminary administration of scopolamin with morphin is of advantage.

Third Stage.—All that has been said regarding the danger of a general anesthetic in the preceding stage is doubly true in this group of patients. Most of these patients are doomed as a result of the pulmonary conditions, and an attempt to alleviate surgical conditions generally means hurrying the end.

Choice of the Anesthetic.—The choice of the anesthetic to be employed when operating upon patients suffering from pulmonary tuberculosis is of the utmost importance. The choice naturally will be determined by the character of the operation necessary, the character of the pulmonary lesion, and, to an appreciable degree, upon the skill of the surgeon.

SPINAL ANESTHESIA.—This form of anesthesia is sometimes advisable in patients in the second and third stages. In the writer's opinion this form of anesthesia is in itself distinctly dangerous; nevertheless cases in advanced pulmonary tuberculosis which have to be operated upon in which local anesthesia cannot be employed are safer with spinal than with a general anesthetic. Some years ago the surgical literature was rife with enthusiastic reports of this form of anesthesia, but, while it is still employed successfully by many operators who have probably attained especial skill in its use, its dangers and ill effects are now recognized. As a matter of fact, the cases of advanced pulmonary tuberculosis that demand operation are few in number, and it is to those in which local anesthesia cannot be employed that spinal anesthesia is especially valuable. The writer's experience with spinal anesthesia is limited to twenty-two cases, in all of which the Gellhorn technic was employed.

Miliary tuberculosis is in itself generally a rapidly fatal disease, and surgical treatment is rarely if ever necessary.

Hewitt² states that patients with old lesions stand anesthesia well. This authority recommends the use of the C. E. mixture, or the C. E. chloroform sequence, or open ether, preceded by the administration of atropin. He believes that nitrous oxid may also be safely employed in chronic cases, but should not be pushed so far as in the normal. Gwathmey and Baskerville³ recommend nitrous oxid as the anesthetic of choice, and warmed chloroform and oxygen as their second choice. They believe ether is contra-indicated. Magaw⁴ states that these patients stand ether well.

Precautions Before Operation.—Presuming that the diagnosis of pulmonary tuberculosis has been made, and a physical examination has shown that the case is in the first stage of the disease, what precautions

can be taken to minimize as much as possible the dangers incident to surgical intervention? In the gynecological department of the University of Pennsylvania it has been a rule that no tuberculous patients are subjected to operation, who are running a temperature of more than 99° F., unless the operation is very urgently demanded. Thus, in the case of ordinary tuberculous salpingitis in a patient exhibiting a slight evening rise of temperature, we believe that it is usually safer to delay operation until such time as the temperature is normal. In the interval this class of patients should receive appropriate hygienic and dietary treatment, and, if it is thought that the fever may be caused by the pelvic lesion, the usual palliative treatment for such conditions is instigated. Usually, after a week or two of such treatment, the temperature returns to the normal and the operation may be performed. With this method, and with patients in the first stage of pulmonary tuberculosis, good results have been obtained. Occasionally a case will be encountered in which the fever continues, and under such circumstances a further delay is usually advisable. A sharp line must be drawn even in patients in the first stage of the disease, between those patients in whom the pulmonary lesions exhibit a tendency to be active and those in whom they are non-active. In the former the risks incident to operation are definite, whereas in the latter it has been our experience that they are small.

The above treatment should be employed in all cases in which a pulmonary lesion is suspected, as, for example, when a virginal patient is found to be suffering from a pelvic inflammatory disease, as the majority of such cases are of tuberculous origin, and, even when the history and physical signs are negative for tuberculosis, it is safe to treat such patients as if they were the incumbents of an incipient pulmonary lesion.

The administration of atropin combined with a small dose of morphin, prior to the administration of a general anesthetic, is advisable in all cases. The morphin quiets the patient, and, as a result, if a general anesthetic is necessary, it is better taken and less is required, and there is a lessened danger of straining, vomiting, etc., while the atropin lessens the secretion of mucus. An expert anesthetist should be at hand, if a general anesthetic is employed. It is of the utmost importance that these patients take the anesthetic quietly, and that they do not "fill up" with mucus during the course of its administration. While atropin and morphin are of distinct value in attaining these ends, an expert anesthetist is of even greater importance. This point cannot be too greatly emphasized.

Especial care should be exerted to avoid chilling of the patient while on the way to and from the operating room.

If a general anesthetic is employed, the operation should be performed as quickly as possible, so that the patient will not be under anesthesia longer than is absolutely necessary. If a general anesthetic is necessary, nitrous oxid is far preferable to ether. The author has had but little experience with chloroform and other varieties of general anesthetics. Gwathmey and Baskerville³ especially recommend the employment of nitrous oxid in tuberculous patients. Some authors recommend that the ether fumes be warmed. This may be of value, but has not been employed by us in our work. The anesthesia should be as light as possible, only sufficient being administered to keep the patient under its influence. This is especially true if ether is employed. On the other hand, much harm may be done by a timid or inexperienced anesthetist, who allows a patient to come partly out of ether during the performance of the operation. This often means that the patient vomits or becomes "filled up" with mucus, and always means that the total amount of ether employed will be greater than if an even anesthesia has been administered. At the completion of the operation and before the patient has come out of the ether, it is generally a good plan to wash out the stomach, as this tends to prevent postoperative vomiting. Vomiting in tuberculous patients is to be especially avoided, owing to the increased strain put upon the lungs. Excessive straining or vomiting may be the means of breaking down hitherto incapsulated pulmonary lesions. The inspiration of mucus should also be especially guarded against, both during the administration of the anesthetic and while recovering from it. The operating room should be warm and chilling of the patient avoided.

Convalescence.—In the tuberculous patient this should be especially guarded. Particular care to avoid chilling, exposure, etc., should be exerted immediately following operation. Vomiting and straining should be eliminated as much as possible by appropriate measures. The administration of a small dose of morphin or codein as soon as the patient begins to come out of the anesthesia is usually advisable and may be repeated somewhat more frequently than with the non-tuberculous patient. With the above exceptions the subsequent surgical convalescence differs in no respect from the ordinary case. The latter treatment is that usually indicated for tuberculous patients in general, and is especially to be recommended for all operative cases.

Results.—Döderlein and Krönig,⁵ Zweifel,⁶ Wahlander⁷ and Mayer⁸ have remarked an exacerbation following surgical intervention in tuberculous patients. Furniss⁹ suggests that this reaction is not due to an actual dissemination of tuberculous material, but that the condition is owing to the "reactivation" of the tuberculous process by the tuber-

culin liberated by the disturbance of the operation. This reaction occurs about twelve hours after the operation, and is characterized by a rise in temperature of 2 to 4° F., an increase in pulse rate, general malaise, body ache and often headache. A reaction such as described by Furniss, but usually somewhat milder, has been observed in many of our cases. Again, a slight reaction is a certainty in many operative cases even when nontuberculous. In our cases this reaction has not, as a rule, been greater than in the nontuberculous. Weil¹⁰ and others have reported cases of miliary tuberculosis following operation upon tuberculous patients.

Prochownik¹¹ has carefully examined 7 cases in which tuberculosis apparently followed gynecologic operation and resulted in death. These were simple operations, such as dilatation and curettage, reposition retrodisplaced uteri, salpingectomy, etc. In 5 of these patients there was no evidence of latent tuberculosis. Prochownik urges the necessity of a thorough examination in all suspected cases of pelvic inflammation which do not yield in a reasonable time to palliative means. As previously stated, our experience has been that in the mild cases, and properly safeguarded, operation is comparatively safe. Kinghorn¹² reports a similar experience. Certainly, however, all tuberculous patients subjected to operation are exposed to definitely greater risks than the non-tuberculous, and this must be taken into consideration when deciding for or against the advisability of operation. Nearly all cases of tuberculosis of the female genital tract, peritoneum, or intraperitoneal organs are secondary, and, in the majority of cases, are secondary to pulmonary tuberculosis. The pulmonary lesions are frequently latent, but are nevertheless a source of danger, and should be definitely considered and safeguarded as far as possible. On account of the predominance of secondary lesions in many cases and the difficulty often experienced in demonstrating small quiescent pulmonary lesions, all cases of genital tuberculosis should be treated as if pulmonary involvement were known to be present.

The following are the results attained in a series of 126 cases of pulmonary tuberculosis operated upon under general anesthesia for various gynecological conditions. Most of these patients had small quiescent pulmonary lesions, and in a few they were of the unsuspected variety, the diagnosis of tuberculosis having been made by histologic examination of the specimen removed at operation, no demonstrable primary lesion in the lungs or elsewhere having been present. All cases in which the end results have been studied have been followed for at least six months and many for much longer periods. In this series there were no operative deaths.

CONDITION OF PULMONARY LESION SIX MONTHS OR MORE AFTER OPERATION PERFORMED UNDER GENERAL ANESTHESIA

<i>Stage of Pulmonary Lesion at Time of Operation</i>	<i>Number of Cases</i>	<i>Improved</i>	<i>No Change</i>	<i>Worse</i>	<i>Dead</i>
1st stage, group A	104	24	76	3	1
1st stage, group B	18	3	13	1	1
II stage	4	0	3	1	0
III stage	0	0	0	0	0
Total	126	27	92	5	*2

CONDITION OF PULMONARY LESION SIX MONTHS OR MORE AFTER OPERATION PERFORMED UNDER NITROUS OXID AND OXYGEN ANESTHESIA

<i>Stage of Pulmonary Lesion at Time of Operation</i>	<i>Number of Cases</i>	<i>Improved</i>	<i>No Change</i>	<i>Worse</i>	<i>Dead</i>
1st stage, group A	54	15	39	0	0
1st stage, group B	10	2	7	1	0
II stage	2	0	2	0	0
III stage	0	0	0	0	0
Total	66	17	48	1	0

CONDITION OF PULMONARY LESION SIX MONTHS OR MORE AFTER OPERATION PERFORMED UNDER NITROUS OXID, OXYGEN, AND ETHER ANESTHESIA

<i>Stage of Pulmonary Lesion at Time of Operation</i>	<i>Number of Cases</i>	<i>Improved</i>	<i>No Change</i>	<i>Worse</i>	<i>Dead</i>
1st stage, group A	50	9	37	3	1
1st stage, group B	8	1	6	0	1
II stage	2	0	1	1	0
III stage	0	0	0	0	0
Total	60	10	44	4	†2

*One of these occurred three months after operation, and was due to an exacerbation of the pulmonary condition directly traceable to the anesthesia. The other death occurred in a case in which the tuberculous origin of the pelvic lesion was only discovered during the course of the routine histologic examination of the specimen removed at operation. Six weeks after operation a tuberculous peritonitis of the ascitic variety developed, a second operation was performed, but death occurred fourteen weeks after the original operation.

† These were two of our earlier cases, and with our present knowledge would not be given ether.

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CHAPTER XIV

TUBERCULOSIS OF THE BREAST

Histologic study of tuberculosis of the breast—Frequency—Primary and secondary infection—Routes of infection—Additional foci of disease—Predisposing causes—Age incidence—Statistics—Varieties—Confluent—Disseminated—Physical manifestations—Initial symptoms—History of cases noted—Tuberculosis of breast in combination with true neoplasms—Differential diagnosis between tuberculosis and certain cases of chronic pyogenic mastitis—Results of postoperative treatment—Bibliography.

HISTORICAL

It is difficult to determine who was the first to describe this form of tuberculosis. In 1829 Sir Astley Cooper¹ wrote of a "scrofulous swelling of the bosom," which doubtless referred to this condition. In 1860 Lancereaux² reported a case, the diagnosis being based upon macroscopic findings. Johannet,³ in 1853, and Valpeau,⁴ in 1854, described this condition. Heyfelder⁵ reported a case occurring in a man of 26 years. Horteloup,⁶ in 1872; Poirier,⁷ in 1883; Demme,⁸ in 1889; Hebb,⁹ in 1893; Khesin,¹⁰ Schede,¹¹ in 1893; Ferguson,¹² in 1898; Parsons,¹³ Delbet,¹⁴ in 1892, and Ressigue,¹⁵ also reported cases. In 1881 Dubar¹⁶ reported a case verified by bacteriologic and histologic examinations. This is perhaps the first authentic case recorded. In 1883 Ohnacker¹⁷ reported two cases, one of which was proven by animal inoculation.

Frequency.—Tuberculosis of the breast is a rare form of infection. Among 196 specimens of various breast lesions in the gynecological laboratory at the University of Pennsylvania, there was one example of tuberculosis. A further analysis shows 91 malignant breast tumors, 75 benign breast tumors, 29 inflammatory lesions (other than tuberculous), and 1 tuberculosis.

Deaver and Herman¹⁸ observed five cases of tuberculosis of the breast in a series of 600 operative cases of mammary disease. This was less than 1 per cent of all cases and constituted 2.5 per cent of the benign lesions. Bloodgood¹⁹ found tuberculous mastitis in 6 per cent of all benign lesions of the breast admitted to the Johns Hopkins Hospital. Scott²⁰ gives the following table:

Acute mastitis (abscess)	380 cases
Chronic	79 cases
Benign tumors (including cysts).....	296 cases
Malignant tumors	1051 cases
Tuberculosis	24 cases

1830

Scott thus found tuberculosis present in 1.31 per cent of a series of 1830 cases of mammary lesions, and in 3.17 per cent of the benign cases. Bull,²¹ in 185 cases of mammary disease requiring amputation, observed one specimen of tuberculosis. Thus, among 2811 breast lesions, tuberculosis was present in thirty-six, or about 1.31 per cent of all cases.

Many cases are recorded as tuberculosis, in which the diagnosis is open to doubt. Durante²² gives notes regarding 150 cases and adds 2 of his own. In some of these cases the diagnosis is not positively proven. No case should be considered to be of tuberculous origin unless on positive histologic or bacteriologic findings. In 1891 Roux²³ accepted 31 cases, at the same time recording 3 of his own. In 1904 Anspach,²⁴ in a careful review of the literature pertaining to this subject, was willing to accept 42 cases as authentic, to which number he added 1 of his own. Ten years later, Deaver and Herman,¹⁸ taking Anspach's series as a basis, were able to collect 87 cases, to which they added 5 new ones. Powers,²⁵ Scudder,²⁶ Bartsch,²⁷ Scott,²⁰ Schley,²⁸ Geissler,²⁹ Brändle,³⁰ Tuller,³¹ Bender,³² and Miles³³ have contributed valuable articles to the literature of this subject.

Primary and Secondary Forms.—Like a similar infection in other parts of the genital tract, tuberculosis of the breast may be either primary or secondary, the latter being by far the most frequent. Indeed, so rare is the former, that its existence has been denied by such authorities as Klebs (quoted by Deaver and Herman¹⁸), Ribbert (quoted by Deaver and Herman¹⁸), and later by Spediacci³⁴ and others. A number of cases of indisputable primary origin have, however, been recorded in recent years. Demme (quoted by Schmidt³⁵), Orthmann,³⁶ Kramer,³⁷ and others have recorded cases in which the organisms have gained entrance through abrasions about the nipple. Indeed it is claimed by Babes³⁸ that the tubercle bacillus is capable of passing through the normal skin. Certainly direct infection of the breast through abraded surfaces, such as cracks in the nipples, must be regarded as the most frequent avenue of infection of the primary variety. Deaver and Herman¹⁸ state that in rare instances tuberculous infection via the lactiferous

ducts incites a primary focus in the alveoli of the breast. Verneuil³⁹ and Verchere⁴⁰ have reported cases of ductile infections.

In the case of secondary infection, the tubercle bacilli are as a rule carried to the breast by way of blood or lymph channels from more or less distant foci. In rare instances a secondary infection may perhaps result from a direct extension from a nearby focus.

This is, however, relatively infrequent. In the lymphogenic form of infection any of the lymphatics of the axillary, cervical and retrosternal nodes and those in the neighborhood of ribs, sternum, pleura and larynx may play an important part. It must be remembered that probably the tubercle bacilli may in some instances pass through, or laterally to, lymph glands without the latter showing macroscopic or even microscopic involvements. It is well known that the cervical lymph nodes may be attacked by tubercle bacilli, which have gained entrance through the tonsils, and yet the latter may be apparently normal.

Routes of Infection.—These naturally vary. In the primary variety a direct infection from without occurs, either through abrasions of the skin covering the breast or nipple, or perhaps, in rare instances, through the lactiferous ducts. Cracks in the nipple are the most frequent route of ingress of the primary form. The so-called primary secondary form of infection, which has been described in a previous chapter, is also possible, that is, a patient with a pulmonary lesion may cause an infection of this region by means of contaminated fingers, etc., the tubercle bacilli being on the hands or clothing, and these, brought in contact with a fissure of the nipple, may lead to a mammary tuberculosis. The route taken by the infection in the secondary case is less certain. In not a few cases of the latter variety, the axillary glands are attacked before the breast. In other cases, the routes have evidently been by way of the cervical lymph nodes. Cignozzi,⁴¹ Bahaud,⁴² Scott,²⁰ Brändle,³⁰ and Deaver and Herman¹⁸ state that the cases in which the axillary nodes escape, merely support the well known pathologic fact that lymphatic nodes may transmit infectious organisms without becoming involved in the disease process. The most frequent route is probably by way of the communicating trunks between the retrosternal lymphatics and those of the breast. These branches follow the mammary branches of the internal mammary artery. In many cases it is impossible to determine the course by which the infecting organisms have reached the breast. Cases have been recorded as secondary to tuberculous arthritis by Khesin,¹⁰ Abraham,⁴³ and Hardouin and Marquis,⁴⁴ but these are probably in many instances really secondary to small quiescent pulmonary lesions, the infection occurring through the lymph or blood channels.

Among 29 cases collected from the literature by Deaver and Herman, and which were believed to be of the secondary variety, the following additional foci of disease were present:

	Cases
Bilateral axillary lymphadenitis	4
Pulmonary tuberculosis	4
Cervical lymphadenitis	5
Tuberculous osteitis of the ribs	3
Tuberculous osteitis, bones of jaw and forearm	1
Axillary adenitis	5
Cold abscesses of forearm	1
Tuberculous infectious maxillary bone and cervical lymphadenitis	1
Pleurisy	1
Tuberculous osteitis of hip joint	1
Pulmonary tuberculosis and osteitis of phalanges ...	1
Entire axilla filled with tuberculous lymph nodes	1
Tuberculous osteitis of knee joint	1
—	29

Predisposing Causes.—As would be expected, tuberculosis of the breast is extremely rare in the male sex. Among the 150 cases collected by Durante,²² 6 occurred in men. Deaver and Herman found 10 cases and some of these are not positively proven. According to these authors, cases occurring in men have been recorded by Heyfelder,⁵ Ferguson,¹² Ressigue,¹⁵ Poirier⁷ (quoted by Deaver and Herman), Hebb,⁹ Schede,¹¹ Demme (quoted by Schmidt³⁵), Parsons,¹³ and Khesin.¹⁰

Age.—Tuberculosis of the breast is most frequent between 20 and 50 years of age, in other words during the period of active sexual life. A combination of the statistics of the primary and secondary cases previously recorded by Deaver and Herman shows the following results:

AGE INCIDENCE

10 to 20 years.....	5
20 to 30 years.....	19
30 to 40 years.....	23
40 to 50 years.....	16
50 to 60 years.....	7
60 to 70 years.....	3
Not mentioned	1

Denme⁸ has recorded a remarkable case, occurring in a male child four days old.

Anspach²⁴ analyzed the reports of 40 cases and found that

	Per cent
28 were married	70
19 had borne children	47.5
12 were single	30
12 had hereditary taint.....	30
6 gave histories of trauma.....	30
8 suffered from mastitis during lactation.....	20
2 were directly inoculated.....	5

Deaver and Herman's statistics of both primary and secondary cases show:

	Cases
Single	13
Married	45
Widowed	2
Males	2
Not mentioned	2
Multiparous	40
Parous	31

Many authors attempt to divide these cases into primary and secondary. As already stated, we are of the opinion that the great majority are secondary, even those cases which are apparently primary; and because of this uncertainty no attempt has been made in our study to separate the two forms. In this connection Deaver and Herman's statistics are of interest, in that, in their analysis of primary cases, 51.1 per cent were parous, whereas in the secondary cases only 27.5 per cent had borne children—a significant study, for in the primary cases direct infection occurs chiefly through a crack in the nipple, which lesion naturally would be expected to be much more frequent in the women who have borne children, as it is in the puerperium that abrasions at or about the nipples are most prone to occur.

TRAUMA.—The actual part played by trauma is difficult to determine, but it is probably not as great as thought by some authorities. The general surgical principles, however, that trauma predisposes to tuberculosis in those persons already infected, probably holds as true in tuberculosis of the breast as in other areas in the body, and undoubtedly, if a latent focus of tuberculosis is present in the breast, trauma is especially prone to light it up. Deaver and Herman found that 13.3 per cent of their primary cases gave a history of suppurative mastitis,

Scudder,²⁶ 18.8 per cent of his, and Von Eberts,⁴⁵ 20 per cent, and of inflammation of some sort complicating lactation 42 per cent. In this connection Scott's²⁰ case is a remarkable one; the patient, aged 34, pierced her breast with a needle, suppuration followed, and a sinus persisted. An area of induration developed, and the axillary glands became enlarged. Tuberculosis was demonstrated by histologic examination of the tissue.

Varieties.—Various classifications for the tuberculous lesions occurring in the breast have been suggested. Perhaps the most simple and satisfactory is that which divides them into (1) confluent and (2) disseminated.

CONFLUENT VARIETY.—This type results from either a pure or a mixed infection, the latter being by far the most frequent. In some cases only a small localized lesion is present, whereas in others the disease progresses until the entire breast is involved. In some instances the entire mammary gland is apparently spontaneously attacked. In advanced cases fistulas, retraction of the nipples, profuse discharge with its accompanying pruritus, involvement of the axillary or other adjacent lymphatic glands occur. Discrete nodules varying in size are probably the most frequent lesions.

The method by which the breast is attacked by the tubercle bacillus is similar to that usually observed in other organs, and differs only because of anatomic conditions present in this region. The invading organisms are generally enmeshed in the stroma of the gland. Here they develop and produce typical tubercles. These gradually increase in size, owing to the development of new tubercles forming in the periphery. In this way, in a variable length of time, usually some months, a palpable mass may be formed. In the meantime fresh areas of infection are probably developing in other portions of the breast, so that in the later stages multiple nodules varying in size are likely to be observed. At a still later stage, the center of the nodules may break down and the contents find its escape through the skin. This results in a sinus, which generally exhibits little tendency to close spontaneously. If examined at this stage, the sinus, of varying length, may be found leading down to an apparently small collapsed abscess cavity, the walls of which are usually hard and indurated. The pus is often yellowish, or brownish, and may contain cheesy particles. As a result of the irritating properties of the discharge, the skin is likely to be inflamed, especially in neglected cases. Owing to absorption of purulent material, the axillary lymphatics are nearly always enlarged. This is the most frequent variety. Sections of the breast may show tubercles in various stages of development.

The so-called "cold abscess," the result of an unmixed tuberculous infection, is rare. It presents the usual character of such a lesion, generally as a smooth, fluctuant, elastic swelling covered by an intact and sometimes normal appearing skin and surrounded by little or no palpable induration. The veins under the skin are often dilated and visible. The axillary glands are rarely involved by this variety, unless sinuses are present. Sinuses from such abscesses are common and often persist over long periods.

DISSEMINATED VARIETY.—There is, as a rule, not much enlargement of the breast, and the nipple and skin covering the gland is normal. Scattered throughout the breast are isolated tuberculous lesions in various stages of advancement. These usually appear as small nodules, often whitish or yellowish in color, and may, on section, contain cheesy material. The course is generally extremely chronic. Scott has described a third variety, known as sclerosing tuberculous mastitis, which he compares to the fibroid form of pulmonary tuberculosis. To this list Ingier¹⁶ has added a fourth form, to which he has given the name of mastitis tuberculosa obliterans. Various combinations of the several forms have been described.

Scott states that in 10 of his 27 cases the most prominent histologic feature was a diffuse sclerosis. In 3 of these cases there were deep seated abscesses, whereas in 4 others superficial abscesses were present. In the remainder solid neoplastic lesions, which were at first mistaken for carcinoma, were removed. If it is to be employed at all, it is to the latter class of cases that the term sclerosing tuberculosis should be applied. More or less sclerosis is present in practically all cases. The writer has had the opportunity to examine only 6 cases of tuberculosis of the breast, but in all the sclerosis in varying degrees was more or less marked. Scott states that the true sclerosing mastitis is most likely to occur in elderly patients, and is, as in his case, commonly mistaken for cancer, a mistake which is generally not discovered until a histologic examination of the specimen has been made. This variety is analogous to the fibroid lesions which occur in the lungs. Tubercles are usually few in number or may be entirely absent. In the terminal stage the breast is small, hard and misshapen. The nipple is often retracted. Tubercle bacilli are present in small numbers. Fistulas rarely occur.

In the obliterating tuberculous variety of mastitis of Ingier the chief lesions are present in the excretory ducts and the peri-acinous connective tissue, with but slight involvement of stroma. In a case, the history of which was recorded by Ingier, an ulcer was present which had destroyed the nipple and part of the adjacent tissue. The granulation had spread

inwards and involved the membrana propria of the smaller ducts and acini. Proliferation of duct epithelium was present in many fields and resulted not infrequently in obliteration of the lumen. The case is described as one of a primary infection of the ducts.

Symptoms.—The majority of cases of tuberculosis of the breast are of the secondary variety. A careful examination will therefore usually reveal a primary lesion or a history suggesting a previous infection in some other part of the body. This most frequently occurs in the lungs, but may be found in other areas. Occasionally there is pain on deep inspiration, and in these cases an X-ray should be taken to determine the possible existence of a tuberculous osteitis of the ribs. A thorough search for a primary lesion should be made. The primary lesion may be well developed and obvious, or it may exist in a small quiescent focus, the demonstration of which is difficult or perhaps impossible. A history of tuberculosis in the patient's family, or exposure to infection, such as living with tuberculous individuals, is common. No age is immune, but the disease is most frequent during the active sexual life. It is more common in the married than in the single.

Deaver and Herman's¹⁸ combined statistics of the primary and secondary cases show the initial symptom was as follows:

Lump	50
Tender lump	4
Lump in neck and breast.....	1
Hardening	1
Acute puerperal mastitis	1
Abscess rupturing spontaneously.....	1
Discharge from nipple	1
Pain	6
Swelling after trauma	1
Pain and hardening	3
Not mentioned	4
Lump in axilla	1

74

This table shows that in the great majority of cases a swelling or tumor-like formation is the most frequent initial symptom. This was the first noticed by the patient in 55 or 74.32 per cent of 74 cases. The lump is usually painless, although trauma not infrequently lights up a more acute inflammation. Unfortunately the appearance of a lump is also the most frequent initial symptom of all breast tumors, and is therefore of little value in differential diagnosis. A moderate amount of pain may be

present and has been observed in about 36 per cent of cases. Retraction of the nipples in the case of Dubreuil,⁴⁷ Verneuil,⁴⁸ and Warden⁴⁸ occurred respectively 11 months, 2 years, and 5 years prior to discovery of tumor. The disease usually runs a moderately rapid course, 10 or 11 months being the average duration prior to operation, it being in this respect more rapid in evolution than even cancer.

The general condition of the patient is frequently good and even in the secondary cases is often fairly satisfactory. In the latter variety, the disease exhibits no especial tendency to occur in advanced cases of pulmonary tuberculosis, but frequently becomes manifest during the early stages of the primary lesion, in this way causing further difficulty in differentiating the primary from the secondary cases. Miles,³³ in his report of 6 cases of tuberculosis of the breast, records the history of 1 remarkable case occurring in a single woman 49 years of age and 2 years past the menopause, in which there was retraction of the nipple and an early discharge of a milk-like secretion through the nipple. There was no swelling or pain, but two years later the lower half of the breast was swollen, tender, and the seat of a tumor the size of a hen's egg.

As already stated, the initial symptom is usually the discovery of a nodule or swelling in the breast. The most frequent location is in the upper outer quadrant, although any part of the breast may be attacked.

Among the 74 cases, 37 occurred on the right side and 28 on the left, 1 case was bilateral, and in 8 the side attacked was not mentioned.

A few cases have been recorded in which both breasts were attacked simultaneously. Walther,⁴⁹ Chiavarelli,⁵⁰ Gilberti,⁵¹ and Abraham⁵² have observed cases in which first one breast and later the other became invaded.

The condition of the skin in this series was as follows:

Adherent	9
Reddened	3
Red and tender	1
Red and adherent	1
Adherent at areola	1
Darkened	1
Dimpled	1
Adherent and discolored at site of fistula	10
Ulcerated in axilla	2
Adherent and ulcerated	6
Hard and discolored	1
Abscesses of skin	1

Fistulas were present in 37.4 per cent of the cases. In Scudder's ²⁶ series fistulas were present in over 50 per cent, and nearly all had enlargement of the axillary lymphatic glands. Naturally the more advanced the case, the greater the likelihood of a fistula being present. The nipple was retracted in 38.6 per cent. Palpable enlargement of the axillary lymphatic gland was observed in 63.8 per cent of cases, occurring more frequently (72.4 per cent) in the secondary than in the primary cases.

Scott,²⁰ in an analysis of 27 cases, found fistulas present in 35 per cent, a definite history of injury in 3 per cent, an acute onset in 6 per cent, skin adherent in 70 per cent, nipple retracted in 30 per cent, and enlargement of the axillary glands in 60 per cent.

The important symptoms, therefore, are the presence of a lump, fistulas, retraction of the nipple, and enlargement of the axillary lymphatic glands. These symptoms should put the surgeon on his guard for the possibility of tuberculosis in the breast, and when in addition they occur in a woman known to be suffering from tuberculosis elsewhere in the body, they must be looked upon as extremely suspicious.

Tuberculosis of the Breast in Combination with True Neoplasms.

—Tuberculosis and cancer in conjunction have been observed a number of times. Klose ⁵³ has collected 17 cases, many of them not above suspicion. He, however, reports 1 case, and Franco ⁵⁴ has observed 2. Killenberger,⁵⁵ Scheidigger,⁵⁶ Rodman,⁵⁷ Bauer,⁵⁸ Warthin,⁵⁹ Moak,⁶⁰ and Berger,⁶¹ have also recorded cases. Tuberculosis of the breast has also been observed in combination with benign tumors. Revel ⁶² has recorded the history of a case of adenofibroma associated with tuberculosis.

It will be observed that the clinical picture is in many cases by no means diagnostic. In considering the treatment, therefore, the variety of tuberculosis and the relative frequency of true tumors of the breast must be taken into consideration, and no valuable time should be lost in determining the character of the lesion beyond possible doubt.

Diagnosis.—Owing to the various forms in which tuberculosis of the breast may appear, and to its rarity, the diagnosis is often difficult, and it may readily be confused with a variety of conditions, among the most frequent of which are carcinoma, fibro-adenoma, retention cysts which have undergone suppuration, simple pyogenic mastitis either of the subacute or chronic form, and less frequently sarcomata and other malignant and benign tumors, syphilis and actinomycosis.

Some forms of tuberculosis are indistinguishable from carcinoma prior to their removal. The age of the patient, other tuberculous foci, and in rare instances the demonstration of the tubercle bacilli in the discharge from the lesion are diagnostic points of value. The latter is of

course positive proof. In Duvergey's ⁶³ case the diagnosis was confirmed by the demonstration of the tubercle bacilli by staining methods in the pus. In Delfino's ⁶⁴ and Mantelli's ⁶⁵ cases the diagnosis was made by guinea pig inoculation with pus aspirated from the abscesses of the breast; and Davis ⁶⁶ demonstrated the organism in the discharge from the nipples in a case of tuberculous mastitis. Biopsy may be of value in certain cases, but it should be remembered that malignant disease is far more frequent than tuberculosis, and when a suspicion of the latter exists, it is better to err on the side of radicalism than on that of prolonged palliative treatment. In the event of a suspicion of syphilis, the Wassermann reaction will naturally be of value, as well as the history and the exhibition of antisyphilitic remedies. Actinomycosis of the breast is an extremely rare condition, only a few cases being on record. If in the latter condition a sinus exists, the discharge may contain ray fungus.

The differential diagnosis between tuberculosis and certain cases of chronic pyogenic mastitis, especially when sinuses have formed, is impossible without laboratory methods. Under such circumstances smear preparations and animal inoculation should be made. As a final step, a small piece of tissue may be excised for histologic examination. More numerous and more typical organisms are likely to be present in the wall of the abscess than in the actual pus; for this reason when obtaining material for examination, it is usually advisable to lightly curette the walls of the abscess or of the sinus, rather than use the discharge only.

In general, it should be remembered that tuberculosis is a rare disease, whereas tumors of the breast are frequent. In doubtful cases and especially in patients presenting a lump in the breast who are at or near the cancer age, no valuable time should be lost in establishing the character of the lesion under suspicion, beyond the question of a doubt, and it is under these circumstances safer to err on the side of radicalism rather than to run the risk of palliating a possible malignant neoplasm.

TREATMENT.—This, as in other forms of tuberculosis, must depend largely upon whether the case be a primary or secondary one, and in the latter event upon the condition of the primary focus. In all primary cases operation offers an excellent hope of cure. The choice of operation must vary with the individual case; in young patients, and when the lesion is localized, excision is probably the operation of choice. In older patients, or when the lesion is extensive, amputation of the breast is more satisfactory. In secondary cases the same lines of treatment hold good in the majority of cases, the danger of recurrence or of the development of other secondary foci must, however, be taken into consideration. These, however, are not especially great, certainly not more than encoun-

tered when operating upon other secondary lesions, such as tuberculous salpingitis or tuberculous bone disease, whereas the results of the operation per se are usually good, and relief of symptoms permanent. With secondary cases which are associated with an advanced or active primary lesion, the surgeon must be guided by the conditions of the individual case and treat the patient accordingly.

When enlarged axillary glands are present, these should be removed, and as such involvement is usually present, this is generally a necessary step to the operation. In those rare cases which present only a chronic abscess, incision and drainage are preferable to excision. Iodoform is often valuable.

The postoperative treatment is important. It is safer to consider all cases as secondary ones and treat accordingly, for as has been stated, small primary lesions may be present which are almost impossible to demonstrate, and these may exhibit activity subsequent to operation. For this reason, all cases should receive an extensive course of hygienic and dietary treatment, preferably under the care of a skilled internist. The exhibition of tuberculin is recommended by many authorities, and probably has some value in increasing the resistant powers of the patient and aiding nature to overcome any small areas of tuberculosis which may have escaped the knife. Indeed von Eberts⁴⁵ advises tuberculin alone in early cases.

End Results.—Owing to the paucity of material, accurate statistics regarding the end results are difficult to obtain. The immediate mortality and morbidity following operation is small. Recurrences have, however, been recorded by Stromberg and Kassagledov,⁶⁷ and by Rabinsohn⁶⁸. In 12 cases collected from the literature by Anspach,²⁴ 4 were well 1 year after operation, 3 were not heard from, 1 died at the end of 3 years from an unknown cause, and the remainder were well, 8, 4, 3, and 2 years afterward respectively. In the primary cases, or in those secondary cases in which the primary focus of infection is small and quiescent, the results are as a rule excellent. In the secondary cases the results are naturally less satisfactory than in the primary, the prognosis in this class of cases depending largely upon the character, activity, location and extent of the primary lesion, and the patient's ability and willingness to adopt proper treatment. A number of instances have been recorded in which other secondary lesions, such as peritonitis, meningitis, or acute miliary tuberculosis have subsequently developed, but in these cases such complications probably occur independently of the mammary condition.

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CHAPTER XV

TUBERCULOSIS OF THE PERITONEUM

Early history—First authentic operation performed by Sir Spencer Wells—Primary intraperitoneal foci—Primary and secondary tuberculous peritonitis—Cases studied with view of determining primary lesion—Routes of infection—Pathology—Classification of tuberculous peritonitis—Varieties—Acute miliary, ascitic, fibroplastic, and suppurative—Latent cases accidentally discovered—Frequency; special frequency among colored race—Variety of tubercle bacillus causing tuberculous peritonitis—Division into groups—Histologic study—Pseudotuberculosis of the peritoneum—Difficulties encountered in differentiating malignancy from tuberculosis—Methods of treatment—Operative complications—Tuberculosis in hernia—Reformation of ascites following operation—Comparison of results of medical and surgical treatment—Bibliography.

HISTORY

The early history of tuberculosis contains comparatively few references to tuberculous peritonitis, despite the works of Bichat, Laennec, Bayle, and others, and it was not until the appearance in 1825 of Louis' dictum, to the effect that chronic peritonitis was usually of tuberculous origin, that the attention of the medical profession became seriously directed to the condition. The first authentic operation performed upon a patient suffering from tuberculous peritonitis is the now celebrated case of Sir Spencer Wells. On Christmas Eve, 1862, Wells operated upon a patient of the surgeon etcher, Mr. F. Seymour Haden. The anesthetic was administered by Clover, and Savage was an assistant. The patient was operated upon under the mistaken diagnosis of an ovarian cyst, and is referred to by Wells¹ in a subsequent publication. This patient recovered, but it remained for Krönig² to trace the subsequent history and thereby adduce the positive proof of an ultimate cure—the first authentic operative cure of this condition. Credit is also due Krönig for urging operative treatment for this condition, first in 1884 and later in 1890. The latter paper contained a report of 139 cases operated upon, 107 of which were improved or well 2 or more years subsequent to operation; and, comparing these results with those obtained by medical treatment, Krönig drew an analogy between tuber-

culosis of the peritoneum and a similar infection of the joints, the operative benefits of which were recognized. This paper was the starting point of the long continued discussion as to the relative merits of the medical and surgical treatment of tuberculous peritonitis.

Stone³ has called attention to the fact which has been overlooked by many historians that in 1884 Dr. Z. B. Adams of Farmington operated upon a patient for this condition, this probably being the first operation performed for tuberculous peritonitis in this country. It is worthy of note that the older writers considered this disease fatal, and it is only with the advent of more modern surgical treatment that a more optimistic attitude has been assumed.

Intraperitoneal Foci.—Tuberculous peritonitis may be either local or general. General tuberculous peritonitis may, as a result of healing, result in a local peritonitis. The reverse is even more frequent. In a previous chapter the subject of tuberculous salpingitis and pelvic peritonitis has been discussed. It is difficult to separate these two conditions. In women, at least, the fallopian tubes are the primary intraperitoneal focus in the majority of cases. In some instances the disease apparently limits itself to the genital tract and to the peritoneum of the pelvis, never assuming the dimensions of a general peritonitis; in other cases it begins as a salpingitis and remains localized for a longer or shorter period, and finally becomes general. On the other hand, in not a few cases of macroscopically localized tuberculous peritonitis which have undoubtedly originated in the tubes (primary intraperitoneal focus) there is a history which indicates that at some stage of the disease there has been a general tuberculous peritonitis, the salpingitis remaining after the general peritonitis has cleared up. Thus the intraperitoneal infection may begin as a salpingitis and subsequently develop into a general peritonitis; or it may begin as a general peritonitis which undergoes cure, but leaves behind a salpingitis. One or more attacks of general peritonitis may occur during the course of a tuberculous salpingitis, the former being the most frequent. Schlimpert,⁴ in a long series of postmortems, found that among females 87.9 per cent of the cases of tuberculous peritonitis were secondary to genital lesions, the tubes being the infecting foci in the great majority of cases. It should be remembered that as long as a tuberculous focus remains in the peritoneal cavity, a potential factor in the production of a general peritonitis is present.

Primary and Secondary Tuberculous Peritonitis.—Primary tuberculosis of the peritoneum is an extremely rare condition—so infrequent, in fact, that before accepting such a case as authentic, a carefully performed autopsy is necessary. Cases reported without necropsy, although

in some instances probably authentic, are open to doubt. Borschke⁵ found 2 cases which he considered primary in 226 necropsies performed upon subjects dying of tuberculous peritonitis. The lungs were involved in 200. Hamman,⁶ in 35 similar postmortems, observed 1 case in which the tuberculosis was limited to the peritoneum. In this case there was, however, an adhesion in the pericardium which may have been of tuberculous origin. In this series pulmonary tuberculosis was present in 18 cases and in 29 either the pleura or pericardium was involved. Munstermann⁷ found 1 case which he believed primary in 46 autopsies upon subjects dead of tuberculous peritonitis. So infrequent is primary tuberculosis of the peritoneum, that its existence has been doubted by some authorities. The well proven fact that tuberculosis under certain circumstances can pass through various tissues without producing definite lesions therein, is however proven by the carefully worked out postmortem results of many observers as to the existence of primary peritoneal tuberculous lesions. Primary peritoneal tuberculosis is not to be confused with those not uncommon cases, in which the primary focus has undergone partial resolution or is in abeyance by the time the peritonitis has become manifest. It should not be forgotten that, in those cases in which there are lesions of the peritoneum, as well as in other areas in the body, it is possible for the peritoneum to be the primary seat, and the other foci to be the secondary. Whereas this is theoretically possible, careful study has shown that this is rarely the case, the reverse being true in nearly all cases. The early history of peritoneal tuberculosis contains accounts of many cases of supposed primary tuberculous peritonitis. Thus Rokitsky⁸ in 1855 was of the opinion that many cases were primary. The primary form is probably less infrequent in young children than in adults.

The lungs are the primary seat in the great majority of cases. Albrecht⁹ studied 200 cases of peritoneal tuberculosis which came to autopsy, with view of determining the primary lesion, with the results shown in table on following page.

Matteson¹⁰ was able to demonstrate tuberculosis in other parts of the body in 50 per cent of his cases and in 75 per cent of those cases which were under 30 years of age. Matteson's statistics are drawn from operative material, and hence show a smaller percentage of secondary cases than would those formulated from postmortems. Among Hamman's⁶ series of 150 cases, definite physical signs of pulmonary tuberculosis were present in 34 patients, and 47 complained of cough.

Routes of Infection.—The tubercle bacilli may gain access to the peritoneum by means of the blood or lymph from either distant or ad-

	Men—per cent	Women—per cent
Lungs	56.4	46.1
Lymphatic glands	15.5	20.8
Intestines	12.6	7.7
Genitalia	0.7	12.1
Bones	1.5	3.3
Pleura	3.7	3.4
Tuberculosis of serous membrane	9.6	3.3
Unknown	0.7	3.3

jacent foci, by contiguity or continuity from other foci, or by direct implantation upon the peritoneum, either from without, as an experimentally produced peritonitis in animals by way of the genital tract, or directly through normal structures, such as the intestine or lymph gland. The passage of tubercle bacilli through normal tissue has been proven. Tubercle bacilli have also been demonstrated in the normal fallopian tube.

Practically there are four chief routes by which infection occurs, (1) by the blood or lymph channels, (2) from an intestinal lesion through the walls of the gut, (3) from a tuberculous mesenteric gland, (4) from a tuberculous salpingitis. Tubercle bacilli may pass through the intestinal wall or through a lymph node without the latter being seriously affected. This is probably of rare occurrence.

The acute miliary variety of tuberculous peritonitis is the result of a blood borne infection, a general tuberculosis usually being present as well as the peritoneal involvement. Tuberculous peritonitis in men is usually secondary to an intestinal lesion, often an ulcer, and generally located in the neighborhood of the cecum or vermiform appendix. In women, the fallopian tubes are the most frequent primary intraperitoneal site, although the appendix and cecum are not uncommon starting points. In children the infection most often occurs from an infected mesenteric gland.

Allshut¹¹ believes that the path of infection is often from the peribronchial lymph tissue through the perforating lymphatics of the diaphragm into the peritoneal cavity, chiefly by the retroperitoneal lymph glands, which he has found are generally involved. In rare instances, according to Goodrich,¹² infection may result from ulceration or infiltration of the diaphragm. Apert (quoted by Goodrich¹²) has recorded the history of such a case. The tonsils are often the entry way for the

tubercle bacilli. Cummins (quoted by Goodrich¹²) has recorded a series of cases in men, in which the infection appears to have been secondary to a tuberculous epididymitis by way of the lymph. vessels of the spermatic plexus.

As has been stated, among women the fallopian tubes are the most frequent primary intraperitoneal focus. One of the characteristics of tuberculous salpingitis is that the abdominal ostia of the tubes tend to remain patulous, a point favoring the spread of the infection to the peritoneal cavity. The involvement is generally bilateral, and the mucosa of the tubes is practically always involved, two conditions also favoring dissemination of the infection to the peritoneum. When a tuberculous salpingitis and peritonitis coexist, undoubtedly either may be the primary intraperitoneal focus. In 1911 Krönig,² in the German Gynecological Kongress, upheld the view that, when these two conditions occurred together, the peritoneum was most frequently the primary infection. Albrecht⁹ stated that, as a result of over 10,000 autopsies and from clinical and experimental studies, he believed the two conditions frequently coexisted; in 33 per cent it would seem that the genital lesion was the primary one, but that the reverse was rarely the case, and when a hematogenous infection occurred, the tubes and the peritoneum were frequently simultaneously involved. Mayo¹³ believes the fallopian tubes the most frequent intra-abdominal site in women, an opinion in which the author concurs. This belief is based upon the fact that in women tuberculous salpingitis is more frequent than is general tuberculous peritonitis, tubercle bacilli being the exciting cause in from 4 to 8 per cent of all tubal inflammations, and that in the majority of cases of tuberculous peritonitis, a careful search in the history will reveal evidences of the existence of a salpingitis some time prior to the onset of the symptoms of the general peritonitis. Mayo¹³ states that in a series of 18 cases, 11 were in women, in 9 of whom the origin was in the tubes, 1 in the vermiform appendix, and 1 unlocated; in the 7 men, 3 originated in the vermiform appendix, 2 in the cecum, and 2 were unlocated. Mayo mentions 5 other cases in which the lesions were most severe in the upper abdomen, the primary intraperitoneal site of which was unknown. These were in older patients. Kraus¹⁴ has recorded the history of a case in which he believed that the adnexal infection was secondary to a tuberculous appendicitis.

Pathology.—The lesions produced by the tubercle bacilli in the peritoneum are in general similar to those resulting from a similar infection in other parts of the body. They are, however, often modified owing to the peculiarities of the intraperitoneal viscera. At the point of implanta-

tion a typical tubercle is developed. In the miliary (hematogenous) variety of infection great numbers of tubercles in various portions of the peritoneum, as well as elsewhere, develop simultaneously. When the inflammation results from the rupture into the peritoneum of a tuberculous focus, the onset may be general. In the other forms of infection the lesion is probably, as far as the intraperitoneal condition is concerned, always local in its incipency. The first area of infection acts as a starting point from which other tubercles are developed, the infection being spread through the peritoneal cavity by peristaltic and respiratory movements, the peritoneal currents, gravity, etc. Tubercles are usually most numerous at or near the primary intraperitoneal foci. The tubercles may be seen as small, elevated, firm areas, varying in size from the microscopic to a few millimeters or more in diameter, and are found in various stages of development. Not infrequently nearby tubercles coalesce, and in this way massive lesions may be developed: in some instances these break down and abscesses of various size result. When actual suppuration takes place, a mixed infection is nearly always present. As a result of the inflammation, peritoneal cysts may develop; these are often thin walled and contain thin, clear, amber colored fluid. In some instances the contents are turbid and discolored. Various lesions may develop; adhesions are the most frequent. These may vary from a few light bands of adhesion situated at the point of the primary intraperitoneal focus, to great masses composed of plastered together intestines, omentum, or other intraperitoneal organs. In the cavities of such lesions, abscesses, cysts, fistulas leading to adjacent organs, or even artificial anastomoses may be present. With the exception of the fallopian tubes, the omentum is the most frequent intraperitoneal organ attacked. It may be adherent to some other focus, such as the cecum or tubes or, as is not infrequently the case, may be found rolled up, forming a more or less nodular sausage shaped mass, often lying diagonally or transversely in the upper peritoneal cavity. On palpation, the rolled up omentum often simulates a true neoplasm. As a result of adhesions, intestinal obstruction may result. Indeed, the fact that obstruction does not develop more often is remarkable, when the frequency and character of the adherent masses often formed is taken into consideration. When much free fluid is present, adhesions are less likely to be a pronounced feature. In such cases the various organs are found floating free in the fluid and less chance for fusion is afforded. Occasionally a cure of the general tuberculous peritonitis occurs, but a local lesion, such as an ulcer or a salpingitis, persists. This may remain dormant, producing no, or only local, symptoms for a long period and may finally undergo resolution;

or may at some future time produce a focus for a fresh involvement of the general peritoneal cavity. Not infrequently in healed cases adhesions persist and may result in troublesome symptoms. Strangulation of the gut, stricture, or intestinal obstruction has been reported, and contractures resulting in painful traction upon various structures are of comparatively frequent occurrence.

Many classifications of tuberculous peritonitis exist. Some authorities consider the various forms separate and distinct, whereas many believe them to be but different stages of the same thing. One of the most widely employed classifications is that which divides tuberculous peritonitis into the (1) acute miliary, (2) ascitic, (3) fibroplastic, and (4) the suppurative. To these Bryant¹⁵ adds a fifth variety, the latent. Osler¹⁶ classifies tuberculous peritonitis as follows: (1) serous, exudative or miliary, (2) nodular or ulcerative, (3) adhesive, fibroplastic or cystic, and (4) purulent.

ACUTE MILIARY VARIETY.—In this variety the peritoneal involvement is usually but an incident to a general infection, and for this reason, the symptoms of the peritonitis are often masked by those produced by the general infection. Death may supervene before the peritoneal involvement becomes pronounced. If the patient survives for a sufficiently long time, ascites, with its accompanying symptoms, develops. In some cases the clinical symptoms are suggestive of typhoid fever. This form of peritonitis is not as a rule amenable to surgical treatment.

ASCITIC VARIETY.—This is the most frequent form of tuberculous peritonitis. In an analysis of 500 cases by Wunderlich¹⁷ the greatest number were found to be the ascitic variety. Stone,³ in 122 cases, found fluid in the peritoneal cavity in 84, or nearly 69 per cent. Hamman,⁶ in a series of 122 cases, found fluid in the abdomen in 42 per cent. Among 103 cases which were operated upon or which came to post-mortem, 35 cases were of the ascitic variety. Baisch,¹⁸ in an analysis of 110 cases from the Tübingen Gynecological Clinic, found the ascitic variety by far the most frequent. In a series of 21 cases from the gynecological department of the Hospital of the University of Pennsylvania, about 60 per cent were of this variety. When the fallopian tube is the primary intraperitoneal focus, the resulting peritonitis is generally of the ascitic variety, so that this variety is especially common in women.

Not only is the ascitic variety the most frequent, but it is also the variety which offers the best hope for surgical cure. As a general rule, the lower half of the peritoneal cavity is the area chiefly involved. This is especially the case in women because of the fact that the fallopian tubes are so frequently the primary intraperitoneal focus. The peri-

toneum is more or less thickly studded with tubercles in various stages of development. The peritoneum itself becomes thickened, hyperemic, and more or less destruction of the endothelial layer occurs. The omentum and the intestines, especially the small bowel, tend to become adherent, and may often be found glued together, forming tumor-like masses, which are generally pushed upwards by the exudate. The variety and character of the adhesions vary markedly. In addition to the omentum and intestines, masses may be composed of enlarged mesenteric glands, or pseudo tumors may be the result by fecal impaction. Probably, in those cases where the effusion occurs early the fluid is found more generally distributed and there are fewer adhesions, whereas, if exudate is formed late, adhesions are likely to be a pronounced feature. If the fluid is encapsulated, the walls of the cavity are, in part at least, composed of adherent coils of intestines, omentum, etc. As might be expected, the character of the fluid varies considerably. It is usually clear, transparent, straw colored fluid, but may become cloudy or turbid from the admixture of various substances. Not infrequently considerable flocculent material is suspended in the fluid. From the admixture of blood the fluid may be reddish, dark brown or even black. If walled off cystic spaces are present, the fluid in some may be clear and in others discolored. When few adhesions are present and in the large cystic spaces the fluid is prone to remain clear, whereas in the small compartment degenerative changes are more likely to occur and result in a dark or turbid exudate. The fluid often contains a high percentage of lymphocytes. The amount of fluid varies considerably; as much as six or eight gallons have been observed.

FIBROPLASTIC VARIETY.—Of Wunderlich's 500 cases, 136 were of the fibroplastic variety. Mayo¹³ believes that while the ascitic variety is the most common and is especially prone to occur in conjunction with lesions of the fallopian tube, the fibroplastic is more frequent as a result of appendiceal tuberculosis or in those cases in which the primary intraperitoneal focus cannot be located. A mixed infection is often present and operative results are less successful than in the previously described form. Stone,³ in 122 cases, observed 37 of this variety. Hamman,⁶ in 103 cases which came to operation or postmortem, observed 63 that were fibroplastic. Baisch,¹⁸ in 110 cases, observed 22 which were of the fibroplastic form.

The fibroplastic variety originates as a localized lesion, in adults often in the appendiceal region, and in children frequently from a tuberculous mesenteric gland. From the primary intraperitoneal focus the disease spreads, generally, however, exhibiting a tendency to remain localized;

adhesions of intestinal or omental origin often wall off collections of fluid. As the disease advances, caseation and ulcerations occur, and some authorities refer to this stage as the caseous or ulcerative variety. The ulcerations may perforate and result in a general peritonitis, or various forms of fistulas may occur. Massive inflammatory products may be present; the peritoneum is thickened and more or less profusely studded with tubercles in various stages of development. The diseased areas are covered with yellowish, whitish, or brownish gelatinous or fibrous material, often thickly plastered over the intestines and peritoneum. As a result of this process, more or less localized areas of a boggy or semiflocculent consistency, composed of adherent viscera and the fibrous exudate, are found. In some instances the fluid is more or less absorbed; the endothelium however proliferates and the new tissue undergoes cicatrization, giving rise to firm adhesions which often result in fecal accumulations and may cause intestinal obstruction or stricture. In some localities the peritoneum may exhibit advanced evidence of the disease, and in others be comparatively or even entirely normal. Nothnagel¹⁹ states that cicatricial contractions are specially marked in the mesentery and omentum. It is important to note that cicatricial masses develop more rapidly than the tubercles, so that the latter become encapsulated and may thus disappear and constitute a more or less complete cure. At operation or autopsy no tubercles may be visible, scar tissue being the only discernible evidence of the disease.

SUPPURATIVE VARIETY.—This is a questionable variety and in nearly all cases is really an end stage of one of the other forms, the fibroplastic especially, tending to result in suppuration. In this variety any of the lesions previously described may be present. It is always the result of a mixed infection. Several varieties of pseudo-abscesses may be present. In some cases one area may be found to have undergone suppuration, while in others the mixed infection and the formation of pus have not yet taken place. The clinical symptoms are severe and the prognosis, either for surgical or medical treatment, unfavorable. Fortunately this variety is not frequent. Owing to the character of his material, Wunderlich's figures regarding suppurative tuberculous peritonitis are unusually high. Ten per cent of his cases were of the suppurative variety. Hamman⁶ saw 5 cases in his series of 103 subjects, all of which were operated upon or came to postmortem. As the advantages of operative intervention have become more recognized, this form of peritonitis has become less frequent.

LATENT VARIETY.—Under this heading Bryant¹⁵ describes those cases which are discovered accidentally. Stone³ reports several instances

of deaths among patients apparently in perfect health and upon whom postmortem showed advanced tuberculous peritonitis. This variety is more frequent among men.

FREQUENCY OF TUBERCULOUS PERITONITIS.—The tubercle bacillus is the most frequent etiological factor in the production of the chronic form of peritonitis. The frequency of the disease in men and women varies considerably. Operative statistics show that women are twice to four times as frequently attacked as men, but curiously enough post-mortem statistics show men more often affected than women. An explanation of this is said to lie in the fact that women are more frequently subjected to operation than are men. Tuberculous peritonitis is frequent among children. Cummins, in 3,405 postmortems, found 92 (2.7 per cent) cases of tuberculous peritonitis. From similar material Grawitz and Bruin (quoted by C. H. Mayo¹³) observed 184 cases among 13,992 necropsies. Among 5,687 intraperitoneal operations performed in the Mayo clinic, 184 (3 per cent) were for some variety of tuberculosis. Härtel (quoted by Behle²⁰) found tuberculous peritonitis in 3.5 per cent of 27,000 postmortems, Friedrich (quoted by Behle²⁰) in 1.9 per cent. Schlimpert,⁴ among 2,173 postmortems upon tuberculous subjects, found the peritoneum involved in 4.9 per cent. Albrecht (quoted by Behle,²⁰) in 2,155 necropsies upon tuberculous subjects, found peritonitis present in 10 per cent. In necropsies upon tuberculous subjects at the Henry Phipps Institute, peritoneal involvement was found present in 2 per cent of subjects, and in 5.9 per cent of all females. Nothnagel¹⁹ refers to statistics varying from 1.25 per cent to others as high as 16.16. The latter high estimate is given by Borschke.⁵ Tuberculous peritonitis is frequent in the young. Thompson²¹ found, over a period of 10 years, that some form of abdominal tuberculosis was present in from 1.67 to 4.51 per cent of all children in three large hospitals in the United Kingdom. In the Mount Sinai Hospital however a much smaller percentage was encountered (0.044 per cent), while in the same period of years in the Edinburgh Children's Hospital 3.70 per cent was observed. Caird²² and Bovaird²³ also refer to the frequency among children. The disease is apparently more frequent in the United Kingdom than in this country. Faludi²⁴ has collected 306 cases which occurred in patients under 15 years of age. Of these nearly one half occurred between 3-7 years of age. The incidence of sexes was nearly equal.

FREQUENCY AMONG THE COLORED RACE.—Tuberculosis in general is well known to be very frequent among the colored race, and this variety of the infection is no exception. Goodrich,¹² Kelly,⁶³ and others have referred to the special frequency among these people, some authori-

ties believing that the disease is twice as frequent among the colored as among the white.

Variety of Bacillus Causing Tuberculous Peritonitis.—Barker²⁵ estimated that 50 per cent of tuberculous peritonitis was due to bovine tuberculosis. The English Commission on Tuberculosis in 1911 placed it at 47 per cent and the German Commission at 63 per cent. It has been suggested that the bovine type gives a more favorable prognosis than the human.

Prognosis.—From a practical viewpoint the majority of cases of tuberculous peritonitis may be divided into two groups, the one in which the prognosis is fairly good if the proper treatment is applied, and the other in which the prognosis is decidedly less favorable. Mayo²⁶ has emphasized this division. The first group comprises those cases in which a definite anatomic starting point for the infection can be demonstrated and removed, such as is frequently observed in women when the fallopian tubes are plainly the primary intraperitoneal focus for the infection. The second group contains those cases in which the intraperitoneal focus of the infection is less well defined and in which, although a considerable quantity of fluid is present, it is contained in numerous compartments, and many adhesions have been formed. The character of the fluid is to some extent also a guide, the clear ascitic fluid being the most favorable. Numerous dense adhesions, the presence of pus, sinuses, extensive involvement of the entire peritoneal cavity, high fever, poor general condition of the patient, and grave primary lesions, such as extensive pulmonary involvements, are, on the other hand, unfavorable.

Symptoms.—As has been stated, these depend upon the stage of the disease and the type of the lesion, and in some cases may be partially masked by the symptoms produced by the primary lesion. The disease occurs in women, chiefly in the child bearing period, although young girls are by no means immune. Alglave (quoted by Jacobson²⁷) refers to a remarkable case, which developed in an infant 3 days old. Death occurred on the sixth day and necropsy showed an advanced general tuberculous peritonitis. In a few cases seen by the author the disease has followed pregnancy in patients the incumbents of pulmonary lesions. Kelly⁶³ has noted similar occurrences. A history of trauma is present in a certain proportion of cases, but is a greater factor among men than among women.

As a general rule, the symptoms are those of a chronic peritonitis, which, as the disease advances, are associated with well defined loss of strength, loss of weight, fever, especially in the evening, rapid pulse, increased respiration, and nausea or vomiting. Occasionally an acute

onset is observed, and when such is the case, the infection is prone to be of a more virulent type. The local symptoms vary widely; in the common ascitic variety the presence of free fluid in the peritoneal cavity with its accompanying phenomena are the chief symptoms. The ascites generally shows a more or less marked tendency to become walled off in compartments. This is especially pronounced as the disease advances. Osler has drawn attention to the fact that some cases exhibit a subnormal temperature, in others the temperature may be normal. As the disease progresses the patients become pale and anemic. The amount of fluid which may be present varies greatly in different cases. Nothnagel¹⁹ reports a case in which 11,500 c.cm. were removed. The amount of fluid occasionally varies in amount in the individual case, and it is not uncommon for patients themselves to remark on this fact. The shape of the abdomen is often somewhat pyriform in tuberculous peritonitis, rather than the flattened top and overlapping sides so commonly observed in other varieties of ascites. The fluid is generally somewhat yellowish, but is often dark from the admixture of blood. It may be clear or cloudy, or contain flakes of lymph or fibrin. In some instances it is milky and opaque. If sacculated, a different appearance of the fluid is often present in the different loculi, the contents of some being clear and straw colored, of others discolored. This difference in the character of the fluid is doubtless due to the stage of the disease in different compartments, to mixed infection, and to some extent to the parts involved. Ross²⁸ believes a high percentage of lymphocytes in the ascitic fluid suggestive of tuberculosis, and an excess of endothelial cells, except in the very early stages, the reverse. Gibbert and Villaret²⁹ have expressed a similar opinion regarding the significance of numerous endothelial cells in the fluid. Old fluid is said to lose its bactericidal properties, and newly formed fluid to contain greater antituberculous action. Edebohls attached considerable diagnostic significance to the occurrence of rounded plaque-like thickenings which are occasionally palpable on the anterior and lateral parietal peritoneum. These vary from 1 to 8 cm. in diameter and feel not unlike urticarial wheals. They occur early in the course of the disease. Murphy³⁰ believed these to be hyperemic in origin. In the fibroplastic type the formation of one or more tumor-like masses is the prominent symptom. These masses are at first somewhat movable, but later tend to become fixed. The masses are tender. When suppuration is present the general symptoms, such as fever, pain, and tenderness, are more marked. Pain is however a variable symptom, and is less pronounced in tuberculous than in other forms of peritonitis, and in some cases it may be entirely absent. More or less pain is,

however, usually present. It must be remembered, also, that tuberculous peritonitis exhibits a tendency towards remissions and may become quiescent for prolonged periods, even without treatment of any kind, and, in a small percentage of cases, may undergo spontaneous cure.

Diarrhea, or alternate diarrhea and constipation, is present in many cases, especially if there are well defined intestinal lesions. For this reason, these cases are sometimes diagnosed as "intestinal indigestion." The spleen is frequently enlarged, but its demonstration is generally difficult. The liver may be enlarged, but is more often unchanged. The skin of the abdomen is tense, waxy, and enlarged veins are often present; pigmentation may occur, and is especially likely to be present on the face. This pigmentation may be so marked as to suggest Addison's disease (Osler,¹⁶ p. 311). In women, in addition to a history pointing towards a bilateral salpingitis, scanty menstruation is often present. In Hamman's⁶ series of 150 cases, 104 had pain, 42 vomiting, 48 constipation, 33 diarrhea, 4 alternating diarrhea and constipation, 6 blood in the stools, 11 pain in the chest, 47 coughs, 34 showed physical evidence of pulmonary tuberculosis, and in 30 cases dyspnea was present, loss of weight in 61, night sweats in 27. The leukocyte count showed 8 cases under 5,000, 38 cases between 5,000 and 10,000, 8 cases between 10,000 and 15,000, 8 cases between 15,000 and 20,000, and 3 cases above 20,000; 70 per cent were under 10,000 and 83 per cent under 15,000. Stone³ has recorded very similar blood findings. When a higher leukocyte count than 15,000 is present, it usually indicates that complications are present. Jaundice, due to obstruction of the ducts, is not uncommon. Individual tubercles tend to become encapsulated by connective tissue, which contracts and then produces a cure. The connective tissue growth is said to be more rapid than is that of the tubercle. If in a given case this be true, a clinical cure results. This fibrous metamorphosis may be often observed in histologic preparations, or even macroscopically at operation, or on the postmortem table. Connective tissue formation may result in partial or complete intestinal obstruction, or in dragging and distortion of the various intraperitoneal viscera, with resulting clinical symptoms. Adhesions may result from fibrous change in the tubercles but are probably more often due to an ordinary inflammatory process.

Diagnosis.—Many cases present a history or physical signs suggestive of the primary infection either in the lungs or elsewhere. Pleurisy as an accompaniment of tuberculous peritonitis has been observed in some cases, and a previous history of an old pleuritic infection is frequently present. A bilateral pleurisy is particularly suggestive. Peri-

cardial effusion may be present, but is infrequent among the cases observed by the author. In women a previous history indicating a chronic bilateral salpingitis is often obtainable. In a smaller percentage of cases a previous history pointing towards the appendix or cecum will be discovered, and in rare instances the upper abdomen will have been the seat of the primary intraperitoneal focus. This however is rare, and in the great majority of cases the fallopian tubes will have been the primary intraperitoneal seat. It should be remembered that in children the mesenteric glands are usually the primary intraperitoneal focus.

As a general rule the diagnosis of tuberculous peritonitis presents no great difficulties. The chronic character of the peritonitis, the loss of weight and strength, the presence of either pus or encapsulated fluid within the peritoneal cavity, the tender masses especially in all but the miliary and ascitic forms, the occasional diarrhea or diarrhea alternating with constipation in those cases in which the intestines are involved, the resistance of palliative treatment, the physical findings, and the previous history, usually render the diagnosis easy. An inflammatory mass in the pelvis followed by ascitis is very suggestive of tuberculous peritonitis, and is the condition present in many cases of tuberculous peritonitis in the female. Beale³¹ has directed attention to the fact that the pain of tuberculous peritonitis is often relieved by pressure. This however is by no means true in all cases. The author has observed patients in whom there was no pain except on pressure. Monro³² and others have referred to the frequency with which the omentum is found rolled up as a nodular transverse cord in the upper abdomen. This is especially common in the fibroplastic variety of the disease. This presence of an omental tumor is very characteristic of tuberculous peritonitis, and with the exception of pelvic tumors this is the most frequent symptom. These so-called pseudo tumors are however generally multiple. Cancer and cirrhosis can usually be easily excluded, as can pelvic neoplasms. Cirrhosis of the liver has been observed in conjunction with tuberculous peritonitis by Rolliston, Osler, and others, and when present, appears to markedly reduce the resistant power of the peritoneum to the tuberculous infection.

From a general carcinomatosis of the peritoneum tuberculosis can be differentiated by the age of the patient, tuberculosis occurring early in life or during the childhood period, and carcinoma generally later. In carcinoma the disease is steadily progressive, and in tuberculosis the course is chronic. Elevation of temperature, pulse, respiration, and night sweats are more constant in tuberculosis than in cancer. Cirrhosis is frequently syphilitic in origin, whereas tuberculosis gives

a history or physical signs of tuberculosis elsewhere in the body. The physical changes in the liver in cirrhosis, the fact that cirrhosis is more frequent in men and is comparatively rare in early life, the blood picture, and the presence or absence of the Wassermann reaction are all diagnostic aids. Cirrhosis can only be mistaken for the ascitic form of tuberculosis, and its differential diagnosis from it should be easy. In cirrhosis the abdomen usually presents the well known saddle bag appearance, the top being flat and the sides pouched out. In tuberculous peritonitis, on the other hand, a pyriform abdomen, of the shape often produced by a greatly overdistended bladder, or by an ovarian cyst, is not infrequently met with. The ascites of cirrhosis is generally free and few adhesions are present, whereas in tuberculosis the tendency for the fluid to become walled off into various sized compartments is pronounced, especially as the disease becomes advanced. As a result of this, movable dullness is less often present.

From ovarian neoplasms, especially those producing ascites and adhesions, the diagnosis may be more difficult. Ovarian neoplasms generally occur later in life, and there is an absence of previous history of tuberculosis elsewhere. Ovarian neoplasms, unless associated with definite inflammatory lesions, do not generally produce fever, hyperpyrexia, night sweats, or intestinal disturbances. If they are associated with inflammatory lesions, there is generally a well marked leukocytosis, which is absent in tuberculosis. The ovarian cyst, even if bound down by adhesions or associated with ascites, will often give a history of a previously movable pelvic tumor without marked evidence of peritonitis; whereas the tuberculosis, even if it has been preceded by a salpingitis, will usually give a history of small bilateral inflammatory tumors and from the start has been accompanied by pain, tenderness, and elevation of temperature. In some cases the differential diagnosis between these two types of lesions is extremely difficult. A careful pelvic and abdominal examination will, however, generally clear up the case.

Occasionally, when seen early in the disease, the onset may simulate typhoid fever. As a rule, the tuberculosis is more insidious in onset, and in any case the differential diagnosis should not be difficult. The author has seen two cases in which tuberculous peritonitis was associated with ovarian neoplasms, one of which was a cystic teratoma and the other a pseudomucinous cyst. In both, the outer surfaces of the tumors were studded with tubercles. In another of our cases the tuberculous peritonitis was associated with a fibromyoma of the uterus, the tubes being tuberculous; in another case a cervical carcinoma was present. Gallstones were found in still another case. Croom³³ has recorded the

history of a remarkable case associated with extra-uterine pregnancy, which had ruptured; there was also tuberculosis of the kidney. Tuberculous peritonitis, occurring as it does in such varying forms, may be mistaken for many of the intraperitoneal diseases, among which may be mentioned sarcoma, omental and mesenteric cysts, renal tuberculosis, ectopic pregnancy, various diseases of the gallbladder, ulcer and cancer of the stomach, duodenal ulcer, appendicitis, ascites due to cardiac or renal disease, and the ascites which is sometimes present as an accompaniment of the infectious diseases of childhood, or polyserositis. Except in extremely atypical cases, the differentiation from the above mentioned conditions should not be difficult. Thomayer⁶⁴ believes that in the ascitic variety of tuberculous peritonitis there is a tendency for tympany to be more pronounced on the right side than in other diseases producing ascites, except cancer. It is stated that this is the case, because in tuberculous peritonitis the mesentery of the small intestines draws them to the right, owing to their oblique insertion, the space thus formed on the left becoming filled with fluid. Whereas this sign is of diagnostic value, the reverse may be the case, and the greatest tympany present on the left side. In many early cases observed by the author, and in some advanced ones, the mesentery has not been markedly diseased and hence has not undergone contraction. The excretion of large quantities of indican, which is so characteristic of diffuse acute peritonitis, is absent in the tuberculous form of the disease. (Nothnagel.¹⁹)

Pseudotuberculosis of the peritoneum is a rare disease, which, from the macroscopic appearance of the peritoneum, may be similar to a true tuberculosis, and in some recorded cases is said to have resembled it to some extent histologically. The etiology of this condition is obscure. It would appear in many cases to be due to a reaction of the peritoneum to foreign bodies. Ascites is rarely present, the disease usually simulating the fibro-adhesive form of tuberculous peritonitis. The foreign bodies may reach the peritoneum through rupture of cystic neoplasms, hydatids, or rupture of some portion of the gastro-intestinal tract. Cobb³⁴ has recorded the history of a case due to vegetable material. Alessandri³⁵ has had a similar case, in which the vegetable residue gained entrance to the peritoneal cavity through the perforation of a gastric ulcer. Meyer (quoted by Cobb³⁴) has seen a case due to cholesterol crystals from a ruptured ovarian dermoid. Hebbring (quoted by Cobb) has recorded the history of a case due to the tenia worm, which gained entrance to the peritoneum from the intestine. Egidi³⁶ has recorded the histories of cases of pseudotuberculous perito-

nititis which have healed after war wounds of the chest and abdomen. The previous history, the absence of tuberculosis elsewhere in the body should make the diagnosis easy in most cases.

The tuberculin reaction is of little practical value in the diagnosis of tuberculous peritonitis and may even be misleading. In some cases animal inoculations may be of value, but this has the disadvantage of requiring considerable time. The tubercle bacilli are demonstrable by staining methods in the ascitic fluid in only a small percentage of cases, and even animal inoculation is not certain. Behle²⁹ states that animal inoculation is positive in only 50 per cent of cases. Paracentesis abdominis is more dangerous than a small incision; if the latter is performed the diagnosis can nearly always be made with certainty, and if any doubt exists, the excision and microscopic examination of a small piece of tissue will render it certain. Animal inoculation of the ground up diseased tissue will give positive results in practically all cases, and is much more reliable than the injection of the ascitic fluid. If a case exists in which the diagnosis is in doubt, a small incision can be made, under local anesthesia if necessary, and if the condition found proves to be one in which operation is indicated, this can then be performed. The author believes this a far preferable method to aspiration with a needle. With the present improved surgical technic, paracentesis abdominis for tuberculous peritonitis or for the diagnosis of vague intraperitoneal lesions, is no longer justifiable. It is less certain and more dangerous. Paracentesis abdominis is not only dangerous, in that grave injury may be done to the intraperitoneal viscera, but it is unreliable. Even if fluid is obtained and negative results obtained by both staining and by the time consuming inoculation methods, tuberculosis cannot be excluded with certainty. Indeed, opening the abdomen alone is not a certain method in all cases, but the percentage of doubtful cases that may be so diagnosed is very much higher than by mere puncture, and if it be supplemented by histologic examination of a small piece of excised tissue and by inoculation of the ground up particles into a guinea pig, it may be regarded as practically certain. Morris³⁷ relates the history of an instructive case exemplifying the difficulties sometimes encountered in differentiating malignancy from tuberculosis. He performed a laparotomy upon a patient, and on opening the abdomen found a condition closely simulating a general carcinomatosis. A small piece of tissue was excised, the abdomen closed, and an unfavorable diagnosis rendered. A complete cure followed, which the patient attributed to Christian Science, which had been employed after leaving the hospital. Through a mistake, the piece of tissue excised at operation

had not been subjected to histologic examination. Subsequent examination of this showed tuberculosis, and the cure was consequently due to opening the abdomen. But it is doubtful if the surgeon received credit for the cure.

Treatment.—Whereas a definite proportion of cases of tuberculous peritonitis will not yield to either surgical or medical treatment, and whereas the hygienic and medical treatment is of the utmost importance and should not be minimized, all cases of tuberculous peritonitis are essentially surgical, and the final decision as to whether or not to operate upon them should be left to the surgeon.

In arriving at a decision as to whether or not to operate upon any given case, many points must be considered and the case carefully studied. Although physical examination of the patient to determine the location and condition of the primary lesion is of the first importance, two other factors besides the condition of the peritoneal lesion must be borne in mind, the first that a certain percentage of cases will recover without operation, and the second that, whereas surgery offers the best hope of a cure in many cases, the end results are, even at best, none too satisfactory. For this reason a conservative attitude should be adopted, and in the majority of cases a preliminary trial of palliative measures is the wisest course. Some surgeons attempt to specify definitely how long this palliative treatment should be tried, and recommend periods varying from 2 to 8 weeks and even longer. All cases should be individualized and no hard and fast rule adopted. As long as the patient continues to improve, operation should be withheld. Unfortunately there are many cases which seem to arrive at a standstill or get definitely worse, and in these the proper decision is often difficult to arrive at. As a general rule, the ascitic variety yields definitely better results by operation and the removal of the primary intraperitoneal focus, than by any other form of treatment. Drainage is not indicated, and often leads to fistulas and mixed infection. The fibroplastic form is decidedly less favorable and must be judged individually; in those cases in which there are great numbers of adhesions, much thickening of the peritoneum, and extensive involvement, especially if sinuses are present, the operative prognosis is poor, and if much purulent material is present, is decidedly unfavorable. Haggard³⁸ states he has never seen a recovery of such a case. The miliary variety is not operable under any circumstances, as death is practically certain from involvement of structures other than the peritoneum.

Simple laparotomy will cure a certain percentage of cases, but if the primary intraperitoneal focus can be removed, this percentage will

be definitely increased, as conclusively proved by Mayo²⁶ and others. It must be remembered that tuberculous peritonitis is frequent in the child bearing period and that, as tuberculous salpingitis is generally bilateral, the removal of the abdominal focus therefore means the sterilization of the patient. Despite this fact, bilateral salpingectomy undoubtedly offers the best hope of cure, and should be resorted to in most cases. The fact that there is a primary focus of tuberculosis present elsewhere, often in the lungs, and that pregnancy so often results disastrously to this class of patients, are added reasons for removing the fallopian tubes. Tuberculous peritonitis is generally associated with sterility. Of Baisch's³⁹ 35 cases, all of whom were in the child bearing period, only 1 became pregnant subsequently. Tweedy⁴⁰ has also referred to the frequency of sterility in these cases. The appendix and cecum should be inspected, and as a rule an appendectomy performed. The fibroplastic variety of tuberculous peritonitis is especially prone to originate from the iliocecal region, and in these cases the removal of this part of the bowel is indicated, when this can be performed without too great danger to the patient.

In women, however, this is relatively infrequently the case. Except in the ascitic variety, a cure is rarely obtained, unless the primary focus is removed, and even in that variety the outlook is greatly improved, if such an operation is performed. Mere removal of the fluid may cure the ascitic form, as the old ascitic fluid loses its bactericidal properties. Even if fluid reaccumulates after operation, it is said to possess a higher opsonic index and thus a higher resistance to tuberculosis than the old fluid. The admittance of air to the peritoneal cavity has been suggested as the reason for cure in some cases, but more recent study tends to show that it is the removal of the old fluid and the formation of new which is the chief beneficial agent. In the older days, the late Joseph Price was in the habit of referring to this as the "sunshine operation." Other theories which have been from time to time advanced to explain the cures sometimes following simple laparotomy are evacuation of toxins in the exudate, hyperemia produced by the operation, light or oxygen introduced to affected area, proliferation caused by operation resulting in encapsulation of the tubercles. The so called floating theory has also been advanced. This theory is based upon the belief that the infection originates in or is kept up by the escape of infectious material from the abdominal ends of the patulous fallopian tubes, and that these remain open because the fimbria are floating in the ascitic fluid. The removal of the fluid gives the tubes a chance to become sealed off and thus prevents the further escape of the infectious material. It is probable

that many factors enter into the cure of these cases. Murphy ³⁰ believed that tuberculosis of the fallopian tubes rarely, if ever, caused closure of the tubes, unless a mixed infection was present. The important point which has been amply proven is that a definite percentage of cases will be cured by simple laparotomy, and a still greater proportion, if it is possible to remove the primary intraperitoneal focus of the infection. Operation offers but little to those cases in which there are numerous small pockets of fluid, much fibrin, and many adhesions, and will, in a certain percentage of cases, result in troublesome fistulae. Fortunately, according to Mayo, the adhesive variety is the most favorable for a spontaneous cure.

Various applications to the peritoneum have been suggested. Judd ⁴¹ recommends hydrogen peroxid, followed by physiological normal salt solution. He further suggests that the hydrogen peroxid is of some diagnostic aid, in that it produces a frosted appearance of the peritoneum, and, after flushing with salt solution, the tubercles stand out as pearly white bodies. Kocher ⁴² recommends swabbing the cavities with an iodoform and glycerin solution. Stocker, ⁴³ as a result of animal experimentation, recommends the application of the tincture of iodine and concludes that the iodine exerts a definite curative action and that the danger of its resulting in adhesions has been overestimated. Other investigators have employed various antiseptics.

Strong antiseptics to the peritoneum are generally contraindicated, and, except in small, walled off cavities, are, as a rule, to be avoided. Probably the advantages of the various agents, which have been from time to time advocated, have been somewhat overestimated and the beneficial results obtained are due more to the surgical measures instigated than to the particular form of application employed. The use of radium or X-ray has been tried in these cases. Our own experience has been that both these agents will very definitely cause an acute exacerbation of pelvic peritonitis in chronic cases, whether of tuberculous or other origin, and in some instances result in the production of an acute general peritonitis. Until the rationale and clinical results of this form of treatment have been more thoroughly established, we would hesitate to employ either of these agents upon the class of cases under discussion.

Hygienic and medicinal treatment is of the utmost importance. In a considerable proportion of cases such a course, together with suitable palliative treatment directed towards the peritonitis itself will result in a cure or at least temporary improvement. A reasonable trial of the palliative treatment should be attempted, but should not be continued too long. Not all cases are operable, but it is a poor principle

to allow what was a comparatively mild case to be converted into a grave one. Prior to the more generally accepted view regarding the advisability of operation in many of these cases, it was not uncommon for this to occur, and even today there is a tendency for the surgeon to receive all the advanced cases, many of which have been treated for prolonged periods by the internist. As a postoperative measure, hygiene and medicinal treatment are, if anything, of even greater importance than in the early stages of the disease. An attempt should be made to place the postoperative patient in the best possible surroundings. Härtel⁴⁴ recommends sanatorium treatment when possible. A suitable climate, good diet, and general hygienic treatment will greatly increase the number of permanent cures. The fact must not be lost sight of that many of these patients have more or less definite pulmonary lesions, and, because of the peritonitis, they are below par and therefore especially subject to an exacerbation of the lung condition. As a general rule the postoperative treatment should be continued for a prolonged period; even after patients are apparently cured they should be urged to exercise proper hygienic measures, and should be kept under observation for at least two years. Even if they have not been sterilized, it is unwise for women to become pregnant for at least this period of time, and in many cases it is better for the patient to permanently avoid conception. This, however, is a point on which each case must be judged individually.

Complications.—OPERATIVE.—What has been said in a previous chapter regarding anesthesia and operation upon tuberculous patients should be considered. Apart from the danger of the operation or anesthetic lighting up preëxisting, although perhaps quiescent, pulmonary lesions, these patients possess distinctly lessened resistance and bear operative trauma rather poorly. Owing to the character of the infection and the type of intraperitoneal lesions often encountered, fistulas of various kinds are especially prone to follow ill advised surgical procedures. For this reason especial care should be adopted in dealing with adhesions, and drainage should rarely be employed. If fistulas result, they are extremely likely to be chronic and difficult to cure. These patients are particularly subject to wound infection, and every effort should be adopted to guard against this complication. Spencer⁴⁵ records the history of an unusual complication, which occurred in a girl 15 years of age. A sinus formed which communicated with an intermittent hematosalpinx and for one year blood was discharged through the sinus at each menstrual period. The condition was verified by operation. The same author reports the history of another case in a girl 18 years of age, in which there was a postoperative fistula through which blood

appeared at each menstrual period for some months following operation. Kaufmann⁴⁶ has recorded the history of cases in which there were several small utero-intestinal fistulas, and numerous instances are on record in which fistulas connecting with the intestinal tract or bladder have been present.

Umbilical fistulas are of rare occurrence, but are less infrequent in tuberculous than in any other form of peritonitis. They are more frequent in children than in adults, and in the latter, when associated with a peritonitis, are almost pathognomonic of tuberculosis. Achard and Leblanc⁴⁷ have recently reported the history of a case.

TUBERCULOSIS IN HERNIA.—This may occur, either as a localized infection, or as a part of a general peritonitis. Any of the various varieties may be present. The neck and bottom of the sac are especially subject to attack. It is more common in men and in children than in women. When starting as a localized infection it may become general. It usually produces periodic attacks of pain and is rarely diagnosed prior to operation. Cornet⁴⁸ was probably the first to report a case of tuberculosis in a hernial sac. Jonnesco,⁴⁹ Hagler,⁵⁰ and Bruns⁵¹ were among the earlier observers of this condition.

REFORMATION OF ASCITES FOLLOWING OPERATION.—Reaccumulation of fluid, following its removal by operation, occurs in certain cases, but is less likely to result, if the primary intraperitoneal focus for infection is removed, than otherwise. Reaccumulation of fluid is not a contraindication to operation and many series of cases have been recorded in which ultimate cures have been attained only after repeated operation. Mayo²⁶ has recorded an instructive series of such cases, some of which have been operated upon seven times. Schley,⁵² Murphy,³⁰ D'Urso (quoted by Jacobson²⁷), and others have reported similar experiences.

Results.—The older literature is replete with reports comparing the results of medical and surgical treatment of this condition—the advantages of the one or other form seeming often to depend on whether or no the given series of cases was reported by an internist or a surgeon. Krönig was the first to call attention to the value of simple laparotomy, and in 1890 reported the results obtained in 139 cases, of which 84 recovered. Shattuck,⁵³ from material obtained from the Massachusetts General Hospital, showed a mortality of 68 per cent in cases treated medically, as compared with a mortality of 37.5 per cent among patients treated surgically. Gelpke⁵⁴ has recorded the results in a series of 71 operative cases, in which there were 4 deaths, as compared with a series of 51 cases treated by medical methods alone, in which there were 6 deaths. Some important statistics have been collected by Bircher,⁵⁵ who, in a

series of 1,295 cases treated surgically, found 69 per cent of immediate cures, but that only 31 per cent were well a year or more after operation. Wunderlich,¹⁷ among 176 cases treated surgically, found that only 26 per cent were well at the end of 3 years. It must, however, be taken into consideration that practically all these cases were the incumbents of a primary focus elsewhere than in the peritoneum, and that a definite proportion of those showing poor end results are doubtless due to this fact. Fenzer⁵⁶ states that 35 per cent are now cured by surgery, which were formally fatal, and Moynihan⁵⁷ presents even more favorable figures. Baisch,³⁹ in the study of 110 cases, found that 40 died within 4 years, about 5/6 of these succumbed in the first year, and that not one died after the fourth year. The cases studied were observed from 5 to 12 years. These, as well as other studies, show that the great majority of fatal cases occurs in the first year following operation. In Baisch's series there were 22 cases of the fibroplastic variety; of these 11 were treated medically and 8 died; among the 11 which were subjected to operation, there were 3 postoperative deaths, while 5 of the remaining 8 were well 5 or more years subsequently. Goodrich¹² states that 25 per cent of patients recover, if treated medically, and 80 per cent if treated surgically, but that of the latter, only 30 per cent survive a 5 year period, 25 per cent perishing in the first year. Caird,²² in 31 operative cases, observed 3 postoperative deaths, 10 were lost sight of, 9 died, 9 were alive for periods varying from 2 to 9 years. Matteson,¹⁰ in a series of 53 cases treated surgically, found that 23 per cent showed no improvement and subsequently died. In none of these cases however did death follow immediately after operation, nor was any directly traceable to surgical intervention. Of 38 cases, the after histories of which it was possible to trace, 44 per cent were cured of the peritonitis. Russanoff reports 24 cases treated surgically, of which 9 remained well from 2 to 5 years after operation. Härtel,⁴⁴ after an extensive review of the literature and an analysis of the end results obtained by medical and surgical treatment, states that the early results of surgery are better, but the longer the periods over which the cases are followed, the closer do the surgical results come to those obtained by medical treatment only. These conclusions are probably reached because of the fact that not a few of the cases treated surgically subsequently succumb, either to a recurrence of the peritonitis, or to some other form of tuberculosis. In this connection Ochsner⁵⁹ states that most cases are first treated medically, and when finally turned over to the surgeon, are in bad condition, and his 50 per cent of recoveries is in the worst cases, whereas, if he had had the case from the beginning, his percentage of

cures would be 75 per cent at least. Marckthurm (quoted by Senn and Friend ⁶⁰) records 36 cases with 21 permanent cures. Rösch (quoted by Senn and Friend ⁶⁰) records 358 cases with 20 operative deaths; 70 per cent are reported as cured. Binnie ⁶¹ believes 30 per cent cured and 25 per cent improved by surgical intervention. Mayo ¹³ reports conclusions based upon 144 operative cases; 59 were operated upon by the older methods, 42 cured, 15 improved, and 2 deaths; in 58 cases the fallopian tubes were removed, 56 recoveries and 2 deaths; in 27 the vermiform appendix was tuberculous and removed, no deaths. Thus, among 144 operative cases, there was a surgical mortality of 2.77 per cent.

The prognosis in children, especially the very young, is less favorable than in adults. Dingwall-Fordyce, ⁶² in a series of 137 cases, found that in the majority the onset was prior to the fourth year, the earlier the onset the more severe the case; the mortality in this series was 46 per cent among the bottle fed infants and 28 per cent among the breast fed. Free fluid was uncommon under 3 years of age.

An analysis of 2356 cases treated surgically, some of which were not subjected to modern surgical methods, shows that there were 39 per cent of permanent cures. A more careful analysis, which includes only those cases in which the report states that they have been definitely followed for a period of 3 years or more, shows 31 per cent of permanent cures. Another 30 per cent are definitely improved, and about 36 per cent die of a recurrence of the peritonitis, of tuberculosis elsewhere in the body, or from intercurrent disease in the three year period following operation. The Mayo series of 144 cases treated surgically with 4 deaths is a fair presentation of the immediate surgical mortality in properly selected cases treated by modern surgical methods.

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